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Fish Bulletin
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DIVISION OF FISH AND GAME OF CALIFORNIA

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FISH BULLETIN No. 20

THE COMMERCIAL FISH CATCH OF CALIFORNIA FOR THE YEAR 1928

By the Staff of the
BUREAU OF COMMERCIAL FISHERIES

CALIFORNIA STATE PRINTING OFFICE
SACRAMENTO, 1930

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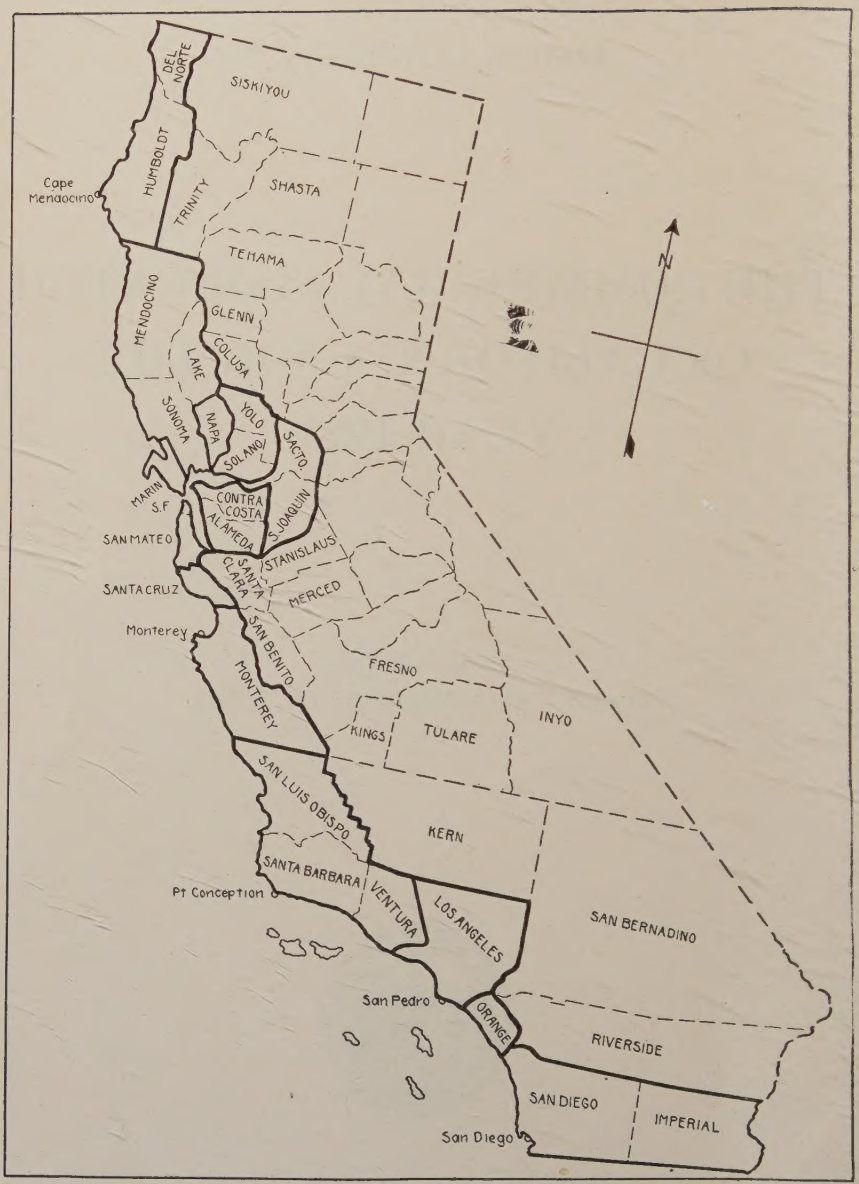

FIG. 1. Map of California. Districts where commercial fisheries products are landed outlined with heavy line.

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The Commercial Fish Catch of California for the Year 1928

INTRODUCTION

By W. L. Scofield

Purpose of this Bulletin.

The Division of Fish and Game of California publishes quarterly tables of fish landings in its magazine, *California Fish and Game.* Annual totals are shown in the biennial reports of the Division of Fish and Game and are also printed for distribution in pamphlet form.[1] The object of this bulletin is to present the more detailed tables showing monthly catches and in addition to comment on certain features by brief text and graphic illustration. Fish Bulletin No. 15 (dealing with the years 1926 and 1927) was the first printing of the monthly tables, and the present publication is the second of what we hope will be a series of annual bulletins presenting fish landings for each month. We hope to enlarge the scope of future contributions to this series to include summaries of the other classes of fisheries statistics collected by the Bureau of Commercial Fisheries.

Important Features of the 1928 Catch.

The outstanding features in the development of our fisheries during 1928 may be briefly summarized as follows:

1. Continued increase in the amounts of fish used for canning purposes as opposed to utilization in fresh fish markets.
2. Sudden development of a mackerel canning industry on a large scale.
3. Continued indications of the failure of our local fishing banks on our narrow continental shelf to supply the increasing demands for fish. An increasing dependence on distant and foreign fishing areas.
4. Extension of the tuna fishing area to far below Cape San Lucas.
5. Importations of albacore from Japan and Hawaii.
6. Commercial utilization of swordfish.

Errors.

Small errors of very minor importance almost inevitably occur in the preparation of such extensive tabular data as these catch records. There are, however, two sources of error here included that we expect to eliminate in future publications. One is the failure of certain canning firms to report all of the fish received. As a result of an audit of the company books, supplementary reports are now being received, and these we expect to summarize in a correction table when the auditing of cannery books has been completed. The other source of error is our failure to clearly indicate those cases where "cleaned weight" is used in our tables instead of the customary "wet weight" or "weight in the round."

[1] Circulars Nos. 1, 2, 3. Statistical report on fresh and canned fishery products, 1926, 1927 and 1928.

Neither of the above errors amounts to any considerable percentage but when calculated in pounds the discrepancies are sufficiently large to warrant correction.

Authorship.

It was explained in the introduction to Fish Bulletin No. 15, that the records of fish catch (forming the backbone of these catch bulletins) are to be credited to the entire staff of the Bureau of Commercial Fisheries.

COMMON AND SCIENTIFIC NAMES OF FISHES, CRUSTACEANS AND MOLLUSKS

The following list has been compiled to indicate as clearly as possible the definite scientific name assignable to each of the common names used in this publication. Due to a lack of agreement among systematic zoologists, questions have arisen concerning the correct scientific name of some of our fish and shellfish. In these instances the expedient has been adopted of using the more familiar form and listing the second name in parenthesis. Since the purpose of this list is merely to make clear the meaning of the common names employed and not to establish precedent for the use of a definite scientific term, this procedure accomplishes that end. The list, originally compiled by J. A. Craig, has been supplemented by Frances N. Clark. The assistance of G. S. Myers and Dr. S. S. Berry in tracing synonomy is gratefully acknowledged.

Common name	*Scientific name*
	Fish
Albacore	Germo alalunga
Anchovies	Engraulis mordax mordax
	Engraulis mordax nanus
	Anchoviella delicatissima
	Anchoviella compressa
Barracuda	Sphyraena argentea
Bonito	Sarda chilensis
Cabrilla—Mexican	Epinephelus analogus
Carp	Cyprinus carpio
Catfish	Ictalurus punctatus
	Ameiurus nebulosus
	Ameiurus catus
Corvina—Mexican	Cynoscion xanthulus
Cultus Cod	Ophiodon elongatus
Eel	Gymnothorax mordax
	Cebidichthys violaceus
Flounders	Platichthys stellatus
	(other Pleuronectidae)
Grayfish	Squalus sucklii
	(and other sharks)
Hake	Merluccius productus
Northern Halibut	Hippoglossus hippoglossus
Southern Halibut	Paralichthys californicus
Hardhead	Orthodon microlepidotus
Herring	Clupea pallasii
Kingfish	Genyonemus lineatus
	(small percentage of Seriphus politus)
Mackerel	Scomber japonicus (Pneumatophorus japonicus diego)[1]
Mackerel—Horse	Trachurus symmetricus
Mullet	Mugil cephalis
Perch	Embiotocidae
	(all species found in California)
Pike (Sacramento)	Ptychocheilus grandis
Pompano	Palometa simillima
Rock Bass	Paralabrax clathratus
	Paralabrax nebulifer

[1] The Pacific mackerel was separated from the Atlantic mackerel by Starks (Science, Sept. 9, 1921), who raised the subgenus *Pneumatophorus* to generic rank. Jordan and Hubbs (Memoirs, Carnegie Museum, Vol. 10, p. 210, 1925) separated the California mackerel from the Japanese, making the former *Pneumatophorus diego.* But according to G. S. Myers, the differing characters intergrade and the subspecific designation *Pneumatophorus japonicus diego* should be used.

COMMERCIAL FISH CATCH FOR 1928

By G. H. Clark

ARRAY

There were almost 60 species of fish, mollusks and crustaceans landed in California during 1928. The amounts vary from a hundred pounds to hundred millions of pounds.

Figure 2 is an array in order of amounts of the first 30 principal species landed in 1928. Sardines are first in order, the total catch of this species being over $2\frac{1}{2}$ times that of all the rest of the fish combined. The mackerel landings have jumped from tenth place in 1927 to second place in 1928, due to the intensive canning of this species during 1928. The rest of the fish hold about the same position as in years before.

MONTHLY LANDINGS OF CANNERY AND FRESH FISH FOR 1928

In figure 3 are shown the monthly landings of cannery fish and fresh fish for 1928. The two classes of fish are plotted on the same graph in order to afford a comparison of seasons. However, the landings for each category are very dissimilar, the cannery fish being many times greater than the catch delivered to the fresh fish markets. In order to plot the two curves on the same graph, it has been necessary to use different scales for the cannery fish and market fish. The scale for the cannery fish is shown on the left hand side, while that for the fresh fish is on the right hand side.

The graph merely shows the high and low points of the cannery fish curve, the peak in February corresponding to the height of the sardine season at San Pedro, and the high point in September to the Monterey sardine season. The fresh fish catch has a fairly constant trend with a slight increase from April to August during the low point of the cannery fish catches. Some boats that usually fish for the cannery species during most of the year turn their efforts to the market fish in the summer months.

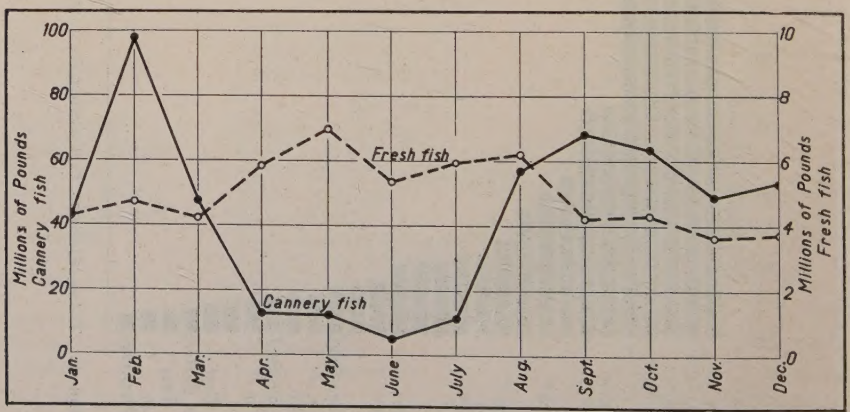

Fig. 3. 1928 landings of cannery fish and fresh fish in California by months. Cannery fish plotted on left-hand scale. Fresh fish plotted on right-hand scale.

CANNERY AND MARKET FISH

By W. L. Scofield

The fishery products landed in California for 1928 amounted to 583,000,000 pounds. This is an excess over 1927 of 96,000,000, and is 188,000,000 more than the landings for 1926. This increase of 1928 over 1926 is greater than the entire catch of the state in 1922.

Approximately nine-tenths of the fishery products landed in the state during 1928 were delivered to the fish canning plants. Only about one-tenth was sold to the fresh markets, salted or smoked. The amounts of fish cured by processes other than canning are relatively small and for convenience are here designated as "market fish," or more properly "market products," when mollusks and crustaceans are included. When roughly classing all fishery products as either "cannery fish" or "market products," we have the following figures for the 1928 California catch:

Cannery fish	522,560,000 pounds
Market products	60,490,000 pounds
Total	583,050,000 pounds

These figures include the mollusks, crustaceans, landings from Mexico, totuava from the Gulf of California,[1] and albacore imported from Japan and Hawaii.

The landings for 1928 were the greatest in the history of the state, but this does not mean that each of our fisheries is in a healthy, growing condition. Several of them are not. The increase in the 1928 catch was not general throughout all fisheries, but the excess over former years was due to those species used for canning. There was a sharp decline in the 1928 catch of species used in the fresh fish markets. The upper portion of figure 4 illustrates the increase from year to year in the amounts of fish used for canning. The amounts so used are such a large percentage that they determine the trend of the curve showing the total catch. We are apt to overlook the fact that fresh market fish landings were less in 1928 than in any of the four preceding years and less than the average for the last seven years. Since the catch for canneries dwarfs the market catch, we have discounted this difference by reducing each to a percentage in order to show the relative increase or decrease for each class ("cannery fish" as contrasted with all other fishery products landed in the state).

For the seven-year period 1922 to 1928, the average annual catch was:

Cannery fish	319,920,000 pounds
Other products	61,440,000 pounds
Total	381,360,000 pounds

The average annual cannery catch was used as 100 per cent, and each year was plotted as a percentage of this average in the lower graph of figure 4. The same was done for "other" fishery products,

[1] The figures, as here used, include only the totuava reported to the state on the triplicate receipt forms. We have recently obtained the record of more than 1,000,000 additional pounds of totuava that were trucked into this state from Mexico during 1928.

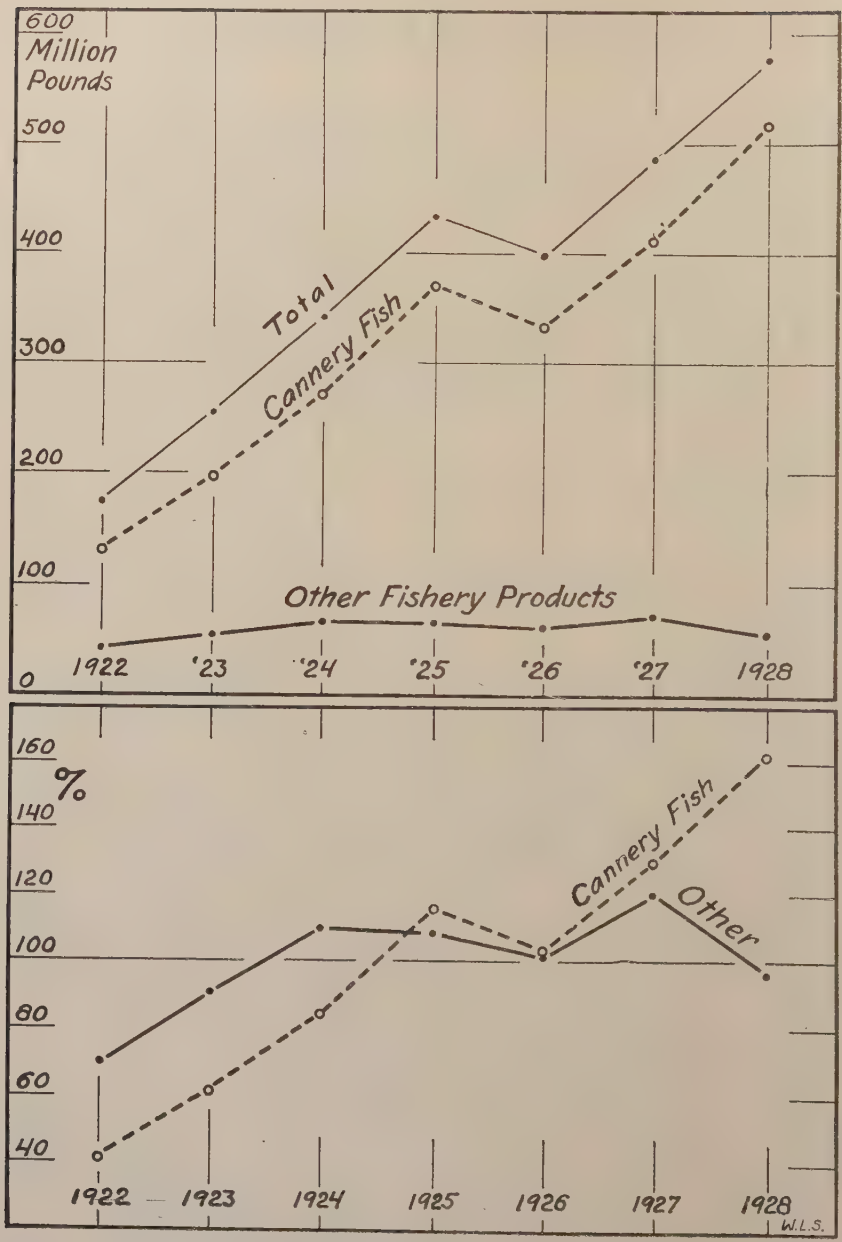

FIG. 4. In the upper portion of this figure, the actual yearly catches are plotted to show the contrast between cannery fish and all other fishery products (including mollusks and crustaceans). In the lower graph these two classes of fish have been reduced to percentages emphasizing the relative rate of change from year to year.

which includes all fresh market fish, mollusks and crustaceans. The plotted results show the great increase in fish used by canneries and the decline in our other fisheries for 1928. The accompanying table of catches for the last seven years shows the segregation of "cannery fish" as compared with all other fishery products landed in the state.

Pounds of Fishery Products Landed in California.

	Cannery fish	*Other products*	*Total*
1922	130,930,000	43,060,000	173,990,000
1923	197,970,000	55,780,000	253,750,000
1924	272,050,000	68,040,000	340,090,000
1925	370,070,000	67,070,000	437,140,000
1926	332,380,000	62,330,000	394,710,000
1927	413,490,000	73,310,000	486,800,000
1928	522,560,000	60,490,000	583,050,000
Totals	2,239,450,000	430,080,000	2,669,530,000

"Market products" are sold in the fresh fish markets all along our coast, whereas canning is conducted chiefly at the ports of Los Angeles Harbor, Monterey, San Diego, and at Pittsburg, near San Francisco. The number of pounds landed in 1928 of these two classes of products are shown in the accompanying table which includes fish, mollusks, crustaceans, and the landings from Mexico, Japan and Hawaii. In this table the districts of the state, represented by groups of counties, are arranged geographically from north to south.

	1928		
Counties	*Fresh market products*	*Cannery fish*	*Total products*
Del Norte-Humboldt	2,420,000	----------	2,420,000
Mendocino-Sonoma-Lake	2,180,000	----------	2,180,000
Marin	3,070,000	----------	3,070,000
Solano-Yolo	510,000	----------	510,000
Sacramento-San Joaquin	740,000	----------	740,000
Alameda-Contra Costa	2,380,000	----------	2,380,000
San Francisco-San Mateo	17,330,000	26,970,000	44,300,000
Santa Cruz	3,510,000	----------	3,510,000
Monterey	6,240,000	222,880,000	229,120,000
San Luis Obispo-Santa Barbara-Ventura	950,000	----------	950,000
Los Angeles	12,060,000	233,930,000	245,990,000
Orange	1,820,000	----------	1,820,000
San Diego-Imperial	7,280,000	38,780,000	46,060,000
Totals	60,490,000	522,560,000	583,050,000

In former years only sardines and the five tunas were canned in quantity, but during 1928 our common mackerel was packed in large amounts as well as some horse mackerel (*Trachurus symmetricus*), so that we have included for the first time a considerable portion of the mackerel catch as "cannery fish." The amounts used in canneries have not been determined with exactness but the following table gives the approximate poundage used by packing plants, either for canning purposes or in the reduction plants. In this table the species have been arrayed from top to bottom in the order of amounts used, and the ports are placed from left to right in the order of their importance.

Cannery Fish, 1928

Species	*Los Angeles*	*Monterey*	*San Diego*	*San Francisco*	*Totals*
Sardines	164,610,000	221,570,000	7,120,000	26,970,000	420,270,000
Mackerel	29,870,000	1,290,000	2,710,000	----------	33,870,000
Yellowfin tuna	15,480,000	----------	16,770,000	----------	32,250,000
Skipjack	6,600,000	----------	9,310,000	----------	15,910,000
Bluefin tuna	11,590,000	----------	2,110,000	----------	13,700,000
Albacore	4,040,000	----------	20,000	----------	4,060,000
Bonito	1,340,000	----------	740,000	----------	2,080,000
Horse mackerel	400,000	20,000	----------	----------	420,000
Totals	233,930,000	222,880,000	38,780,000	26,970,000	522,560,000

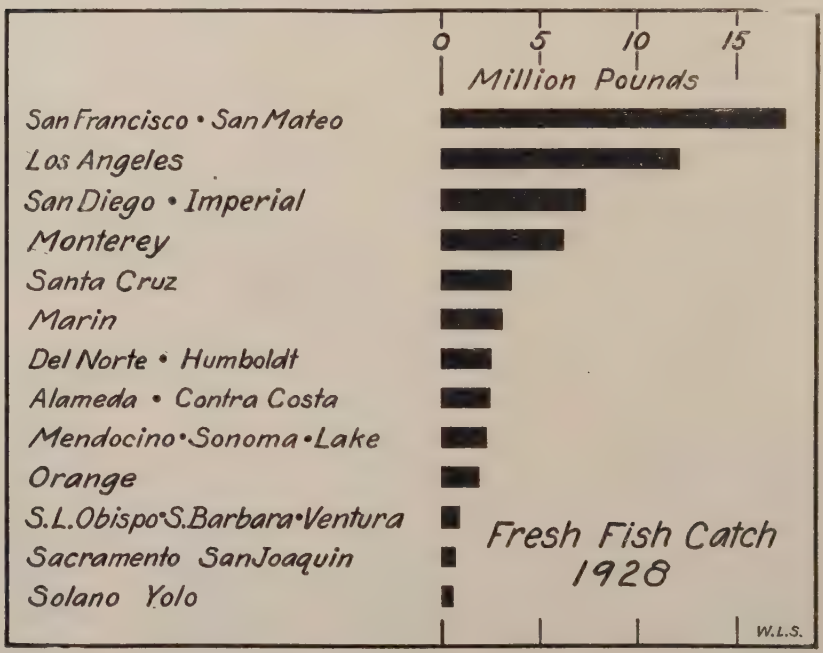

FIG. 5. The districts of California arranged in the order of amounts of fishery products handled in the fresh fish markets. The figures include mollusks and crustaceans.

San Francisco leads in the handling of fresh fish, mollusks and crustaceans, as may be seen from the accompanying table and figure 5, in which the districts of the state have been placed in the order of amounts landed (exclusive of cannery fish) during the year 1928. The market fish brought up from Mexico, as well as mollusks and crustaceans, have been included.

Products Sold to Fresh Markets in 1928

Counties	*Pounds*
San Francisco-San Mateo	17,330,000
Los Angeles	12,060,000
San Diego-Imperial	7,280,000
Monterey	6,240,000
Santa Cruz	3,510,000
Marin	3,070,000
Del Norte-Humboldt	2,420,000
Alameda-Contra Costa	2,380,000
Mendocino-Sonoma-Lake	2,180,000
Orange	1,820,000
San Luis Obispo-Santa Barbara-Ventura	950,000
Sacramento-San Joaquin	740,000
Solano-Yolo	510,000
Total	60,490,000

The several species grouped under the general name "sole" lead the list of fishes handled for the fish markets of the state. Of the first twelve kinds of fishery products so handled, four are mollusks or crustaceans. In the accompanying table and figure 6, the kinds of fish have been arrayed as to pounds landed during 1928. Under rockfish are grouped the many species of the genus *Sebastodes,* and the northern and southern halibut are combined. White sea bass, as here used, includes the "totuava" and "corvina" trucked into San Pedro from the Gulf of California.

Fresh Fishery Products for 1928

Species	*Pounds*
Sole	10,280,000
Barracuda	6,450,000
Rockfish	6,420,000
Salmon	4,480,000
Crabs	3,570,000
Yellowtail	2,680,000
Shrimps	2,280,000
White sea bass	2,156,000
Shad	2,090,000
Abalone	2,070,000
Halibut	1,560,000
Squid	1,350,000
Herring	1,140,000
Sandabs	1,110,000
Spiny lobster	1,080,000
Sablefish	920,000
Smelt	920,000
Cultus cod	854,000

In order to learn of the many species handled in the fresh fish markets of each district of the state, one should consult the tables at the back of this bulletin. It will be of interest, however, to illustrate here the three leading species delivered to the markets of each district. These figures include mollusks, crustaceans and fish caught off the coast of Lower California. The groups of counties are arrayed geographically from north to south in the state. The fish used in canneries have been omitted.

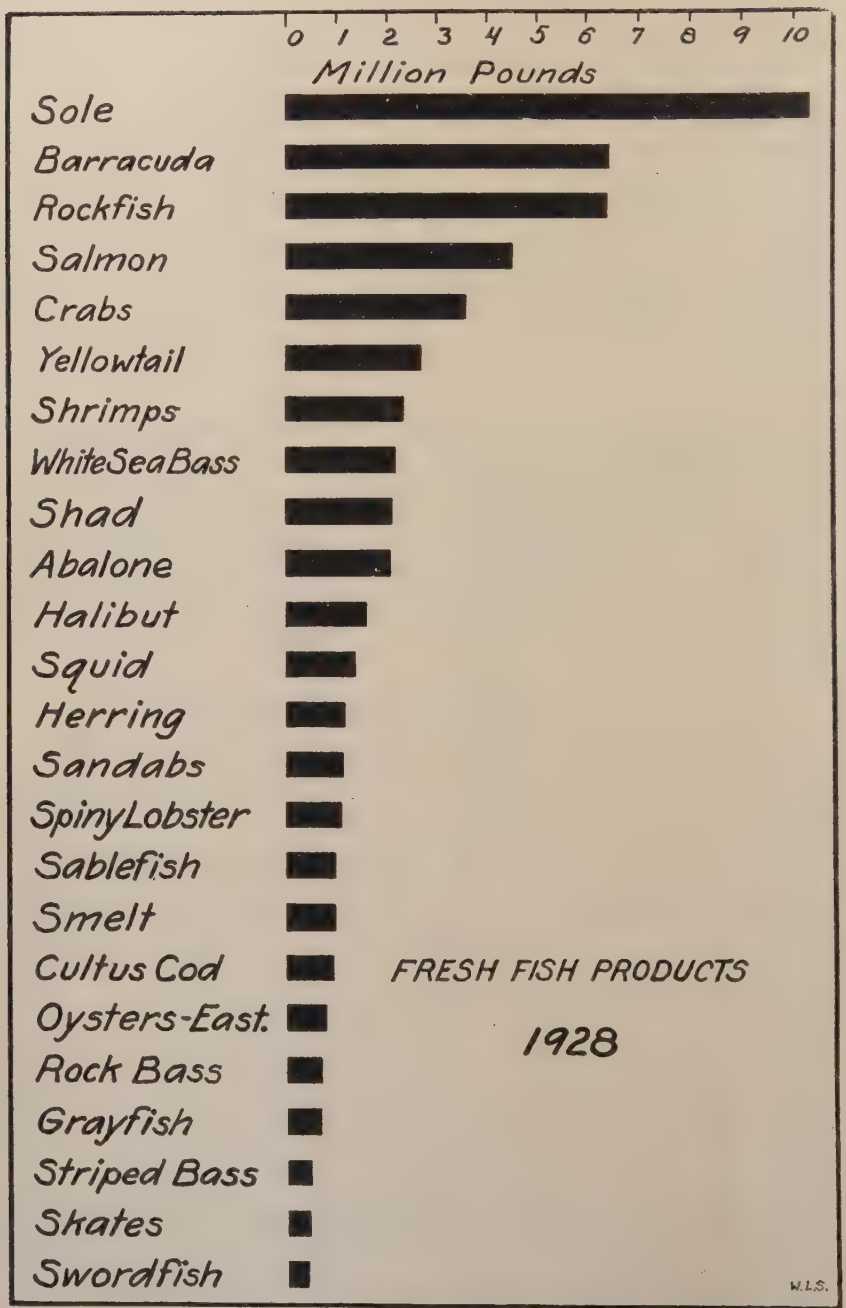

FIG. 6. An array of the more important fresh fish products delivered to California markets in 1928. Those species that were delivered to canning plants have been excluded.

Fresh Market Fishery Products, 1928

Counties	*Species*	*Pounds*
Del Norte-Humboldt	Salmon	1,210,000
	Sablefish	380,000
	Northern halibut	320,000
Mondocino-Sonoma-Lake	Salmon	1,560,000
	Sole	220,000
	Carp	70,000
Marin	Shrimps	1,930,000
	Herring	440,000
	Eastern oysters	430,000
Solano-Yolo	Shad	330,000
	Salmon	120,000
	Striped bass	40,000
Sacramento-San Joaquin	Catfish	230,000
	Salmon	180,000
	Striped bass	130,000
Alameda-Contra Costa	Shad	1,570,000
	Striped bass	300,000
	Salmon	260,000
San Francisco-San Mateo	Sole	7,960,000
	Crabs	3,010,000
	Rockfish	1,000,000
Santa Cruz	Sole	1,510,000
	Rockfish	690,000
	Crabs	460,000
Monterey	Abalones	2,050,000
	Rockfish	1,600,000
	Squid	1,350,000
San Luis Obispo-Santa Barbara-Ventura	Southern halibut	250,000
	Sole	220,000
	Pismo clams	120,000
Los Angeles	Barracuda	5,180,000
	Totuava	2,110,000
	Rockfish	1,660,000
Orange	Rock bass	130,000
	Smelt	90,000
	Barracuda	50,000
San Diego-Imperial	Yellowtail	1,870,000
	Rockfish	1,230,000
	Barracuda	1,200,000

THE 1928 CATCH COMPARED WITH AN AVERAGE OF THE THREE PRECEDING YEARS

By W. L. Scofield

In order that the 1928 catch of each species may be readily appraised, the following table has been prepared to show the average annual catch for the three years 1925, 1926 and 1927. This average has been considered as 100 per cent. The 1928 catch of each species was then calculated as a percentage of the three-year average. Thus, when any species is here shown as less than 100 per cent, it means that the 1928 catch dropped below the average for the three preceding years. The names of those species, which in 1928 dropped below the average, are printed in italics. Mollusks, crustaceans, landings from Mexico, and the albacore from Japan and Hawaii have been included. Species averaging less than 1000 pounds per year have been omitted. In the case of mackerel and horse mackerel, the average was based on 1926 and 1927, because the two species were not separated in our tables for 1925.

Species	*Average annual catch in pounds, 1925–1928*	*1928 catch as percentage of the average*
Albacore	9,752,000	42
Albacore (local)	9,537,000	3
Anchovies	184,000	194
Barracuda	6,409,000	101
Bonito	1,902,000	111
Carp	77,000	204
Catfish	332,000	138
Cultus cod	630,000	136
Flounders	617,000	65
Grayfish	502,000	155
Hake	55,000	198
Northern halibut	356,000	106
Southern halibut	1,702,000	70
Hardhead	34,000	182
Herring	829,000	137
Kingfish	517,000	85
Mackerel	4,182,000	842
Horse mackerel	353,000	153
Mullet	43,000	193
Perch	248,000	96
Pike	6,000	67
Pompano	25,000	120
Rockbass	497,000	126
Rockfish	6,473,000	99
Sablefish	630,000	145
Salmon	7,374,000	61
Sandabs	1,330,000	83
Sardines	314,771,000	134
Sculpin	150,000	67
White sea bass	2,117,000	114
White sea bass (local)	1,057,000	78
Black sea bass	345,000	111
Shad	2,482,000	84
Sheepshead	116,000	322
Skate	227,000	202
Skipjack	22,997,000	69
Skipjack (local)	9,611,000	46

Species	*Average annual catch in pounds, 1925–1928*	*1928 catch as percentage of the average*
Smelt	867,000	106
Sole	9,297,000	111
Splittail	7,000	157
Striped bass	745,000	65
Suckers	3,000	33
Swordfish	68,000	626
Tomcod	7,000	171
Bluefin tuna	5,076,000	270
Yellowfin tuna	17,246,000	186
Yellowfin tuna (local)	2,085,000	41
Turbot	3,000	300
Whitebait	97,000	139
Whitefish	301,000	74
Yellowtail	4,143,000	65
Total "fish"	426,145,000	135
Total "local fish"	391,142,000	132
Crabs	3,164,000	113
Shrimps	1,530,000	149
Spiny lobsters	1,384,000	78
Abalones	2,410,000	86
Clams—cockle	9,000	256
Clams—mixed	54,000	83
Clams—Pismo	244,000	52
Clams—Softshell	220,000	68
Cuttlefish	78,000	13
Mussels	23,000	9
Oysters—Eastern	578,000	125
Squid	3,680,000	37
Total "local" products	403,590,000	131
Grand total	439,520,000	133

YEARLY DISTRICT LANDINGS

By S. S. Whitehead

The trends of the total landings of fishery products in the four districts, San Francisco, Monterey, Los Angeles and San Diego, are upward. (See figure 7.) The reasons for these upward trends are that the catches of sardines and the tunas have increased greatly since 1916.

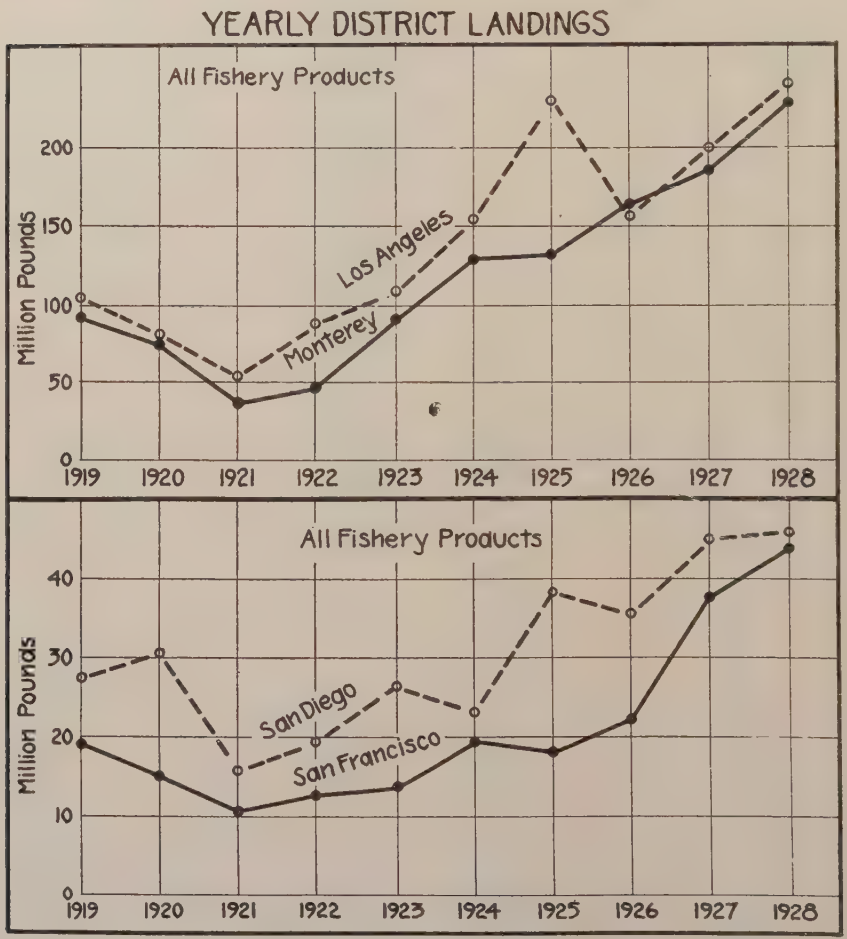

Fig. 7. Yearly landings of fishery products in the four important California districts, including cannery fish, fresh fish, mollusks, crustaceans and landings from Mexico, but not albacore from Hawaii and Japan.

At Monterey the increased sardine catch has exceeded the catch of all other fishery products many times. Even at San Francisco the upward trend has been caused by the large sardine catch since 1925. The increase at Los Angeles and San Diego has been due to sardines and the tunas, while at Los Angeles in 1928, the mackerel cannery catch was also responsible.

When the cannery fish (sardines, albacore, bluefin tuna, yellowfin tuna and skipjack) have been excluded, the trends are nearly level: Monterey and San Francisco have slight upward trends, San Diego a level one, while Los Angeles has a downward trend. (See figure 8.)

In figures 7 and 8, mollusks, crustaceans and landings from Mexico were included, while landings of albacore from Japan and Hawaii were not included.

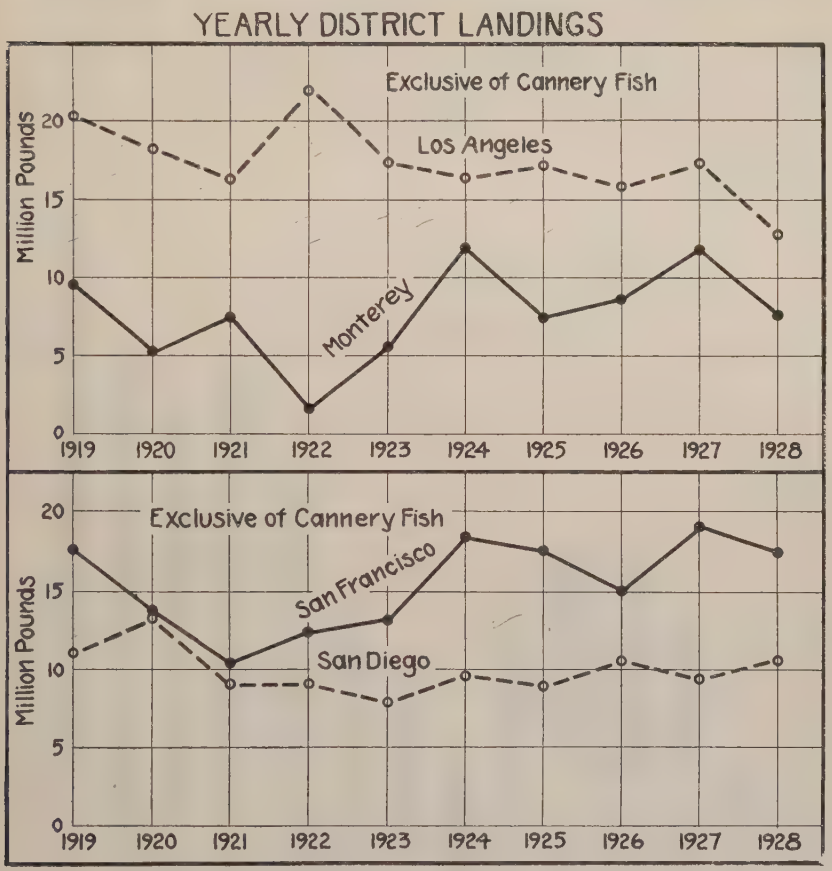

FIG. 8. Yearly landings of fresh fish, mollusks and crutaceans in the four most important California districts. Cannery fish not included.

SARDINES

By W. L. Scofield

The 1928 landings of fishery products in California exceeded the total catch for 1927 by 96,000,000 pounds. Eighty-one per cent of this increase was due to the greater utilization of sardines in the packing plants of the state during 1928. The sardine catch alone is almost three times as great as the combined catches of all other species. If we consider only our local catches and exclude the importations from Mexico and Japan, we find that the sardine landings for 1928 were

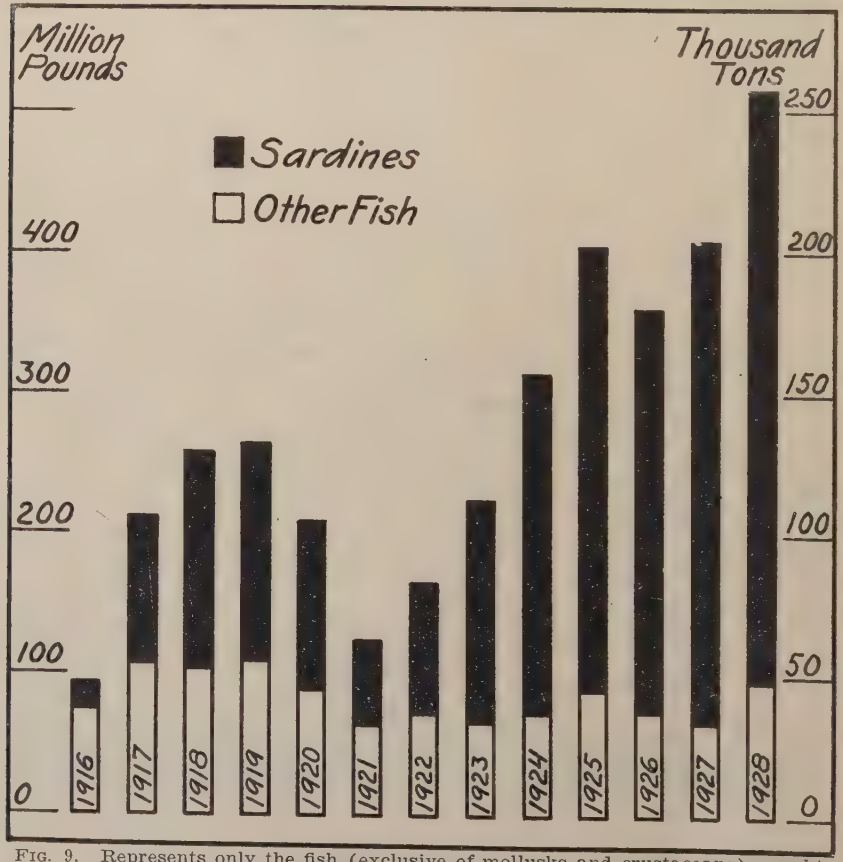

Fig. 9. Represents only the fish (exclusive of mollusks and crustaceans) caught off the coast of California. Catches made off the coast of Mexico and the albacore from Japan and Hawaii are not included. "Other Fish" includes the combined catches of all species of fish except sardines. The top of the black bar represents the total of our so-called "local" catch.

about four times as great as the total of all other species. The 1928 sardine catch of California was 420,270,000 pounds (210,135 tons), which is an excess over 1927 of 78,000,000 pounds (39,000 tons). Because the sardine landings are so great in comparison with the combined catches of all other species, it is evident that any increase in the use of sardines will profoundly affect the total catch of the state.

In order that the sardine totals may be compared with the catches of other species of fish, we have prepared the graph shown in figure 9. In this graph the mollusks, crustaceans, Japanese albacore, and catches made off the coast of Mexico have been excluded.

In figure 10 the sardine catch by calendar years is presented to show the fluctuations from year to year and to contrast the landings in the three counties where the chief utilization of sardines occurs.

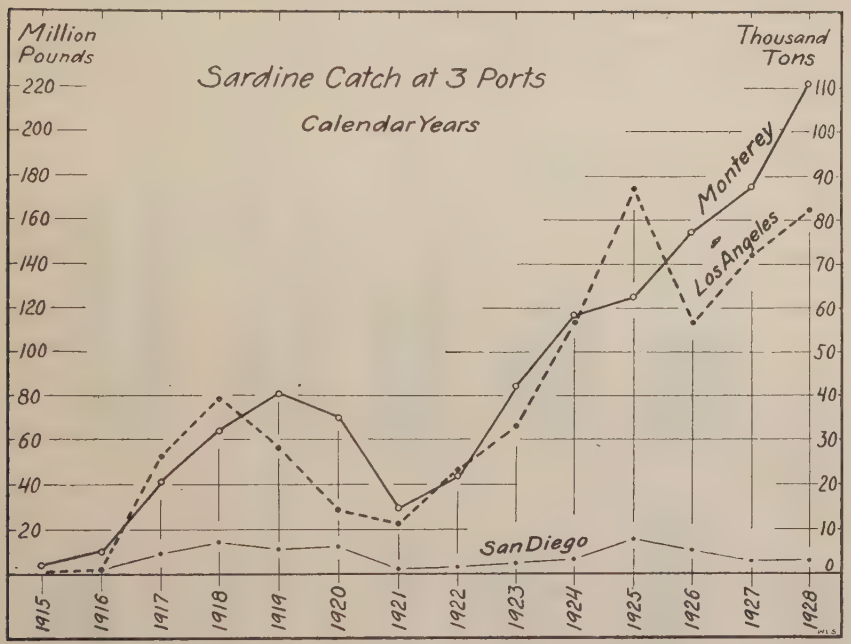

FIG. 10. Annual sardine catch at Monterey, Los Angeles Harbor and San Diego for the 14-year period 1915–1928.

The accompanying table is presented to show the sardine catch by fishing seasons at the two leading ports of Monterey and Los Angeles Harbor (including San Pedro, Wilmington and Long Beach). To allow for the natural difference in the fishing seasons at the two ports, the Los Angeles season was calculated as July 1 to June 30 of the following calendar year. At Monterey the dates May 1 to April 30 were used.

Sardine Catch By Fishing Seasons

	Los Angeles County	*Monterey County*
1916–17	38,050,000	15,380,000
1917–18	86,340,000	46,010,000
1918–19	60,100,000	72,200,000
1919–20	31,430,000	86,180,000
1920–21	23,310,000	49,910,000
1921–22	38,300,000	32,570,000
1922–23	66,340,000	57,930,000
1923–24	70,080,000	92,250,000
1924–25	192,670,000	134,650,000
1925–26	123,610,000	139,660,000
1926–27	130,300,000	152,820,000
1927–28	134,950,000	198,930,000

Above figures rounded to the nearest 10,000 pounds.

Figure 11 is presented to illustrate the sardine seasons for Los Angeles and Monterey counties. The monthly catches of 1924 to 1928 and the first three months of 1929 are shown. The Monterey season is chiefly from August through March, whereas the Los Angeles season is from October through March with some catches in April and May. These seasons will be somewhat modified by the new sardine law which went into effect the middle of July, 1929. Such a bar chart as figure 11

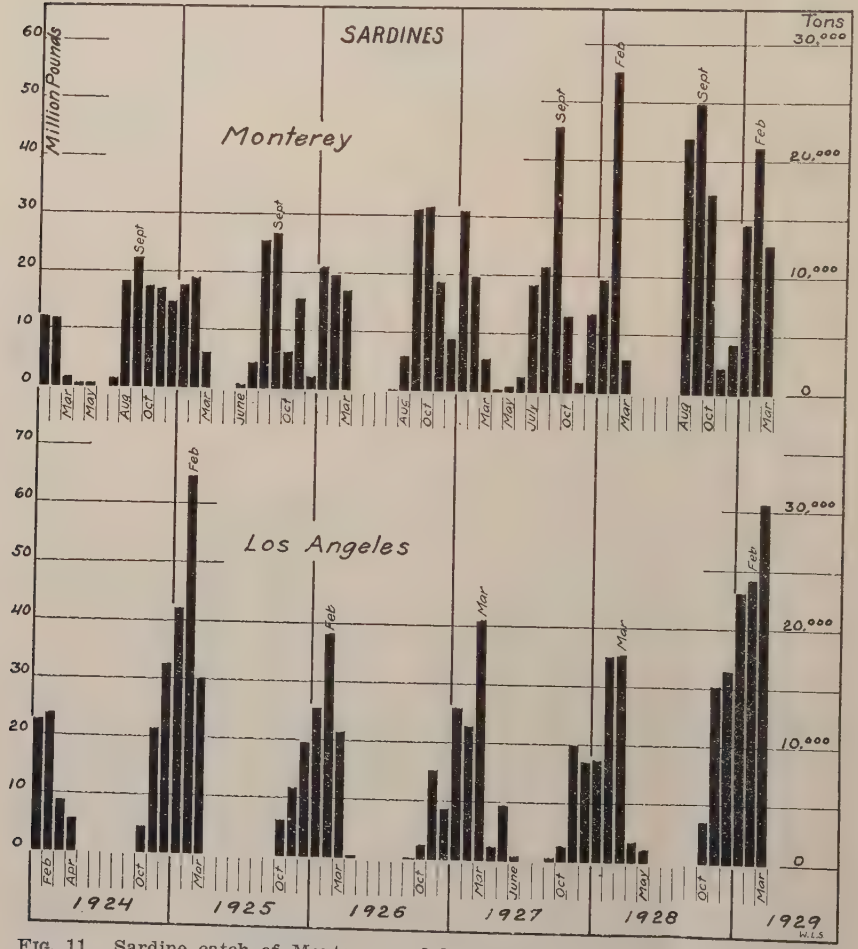

FIG. 11. Sardine catch of Monterey and Los Angeles counties for each month from January, 1924, to March, 1929.

is useful in comparing the catch of one month with that of another, but is apt to mislead one in judging the total for the year. Consult the above table for the yearly totals by fishing seasons and figure 10 for the calendar year totals.

MACKEREL

By D. H. Fry, Jr.

The mackerel[1] catch of California jumped from 5,000,000 pounds in 1927 to 35,000,000 in 1928, and is still going up. In 1927 it ranked tenth among the fishes of the state in pounds landed; by the end of 1928 it was second only to sardines.

The reason for this enormous jump is quite evident. From being essentially a market fish, nearly all sold fresh within a few hundred miles of its place of capture, the mackerel has become one of the most important cannery fishes of the Pacific coast, with a market extending all over the world.

The market for canned mackerel was for many years so limited that none of the canners wished to gamble on being able to create a demand. As a result mackerel was canned only on a small scale prior to 1928. This state of affairs would probably have continued indefinitely had not the Toyo Fisheries (Wilmington, California) decided the chance was worth taking. In 1926 this company began making experimental packs. They soon evolved a satisfactory product, and in October, 1927, started canning mackerel in earnest. The product they had developed practically created its own market, and such was their success that other companies in the San Pedro district soon began to follow suit.

In June[2] of 1928 the Coast Fishing Company started packing, to be followed in July by the General Fisheries and Wedum. (The latter dropped out in September, but when reorganized as the Linde Packing Company, reentered early in 1929.) The French Sardine and Southern California packing companies went to work in August, 1928, and the Van Camp Sea Food Company in October. In November, two other canners, the Halfhill Packing Company and the Gaskel Corporation, entered the business, but packed on a far smaller scale than those already in the field.

At San Diego during 1927, four canneries packed small quantities of mackerel at odd times. (These packers were the San Diego Packing Company, Cohn-Hopkins Incorporated, Westgate Sea Products Company and Van Camp Sea Food Company.) In February, 1928, Cohn-Hopkins started packing steadily and on a much larger scale, and in November, K. Hovden Company joined in. Westgate and San Diego packed irregularly as in 1927. At San Diego only 25,000 cases were packed in 1928 as compared with 360,000 at Los Angeles.

In Monterey several canneries prepared to put up a large pack, but as the fish were not delivered at the packing plants in sufficient quantities, only about 1000 cases were canned. There were enough mackerel for the fresh fish markets, but none to spare.

The accompanying table showing the cases of mackerel canned in California, has been compiled from the records of the Bureau of Commercial Fisheries of the Division of Fish and Game.

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[1] The common mackerel of California (*Pneumatophorous japonicus diego*) is found along the entire California coast, but is abundant only from Monterey south. Because of similarity of name, the mackerel is often confused with the horse mackerel (*Trachurus symmetricus*). Actually these two fishes belong to different families. Owing to the similarity of names, it was found impossible to segregate the two species in catch records until the end of 1925. Of the years on record prior to 1928, the horse mackerel catch averaged about 8½ per cent of the mackerel catch. In 1928 canning operations increased the mackerel catch to over 66 times that of horse mackerel.

[2] The Kittle-Joerissen Canning Company, which had been canning small amounts of mackerel for several years, put up a pack in February, March and April of 1928, after which the firm sold out to the French Sardine Company.

TABLE I

Cases of Mackerel Canned in California

Type of can	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928
San Pedro District											
1 pound	3,450	1,995	3,244	255	205					10,725	357,136
½ pound	4,068	6,344	75								4,717
¼ pound		988									
½ Oval						3					
1 Oval Fillets						3,783	5,229				
San Diego District											
1 pound		66							4		25,110
½ pound		17	6							236	208
¼ pound			13								270
½ Oval									9		
Monterey District											
1 pound			67			271					1,030
½ Oval									537		
State Total											
1 pound	3,450	2,061	3,311	255	205	271			4	10,725	383,276
½ pound	4,068	6,361	81							236	4,925
¼ pound		988	13								270
½ Oval						3			546		
1 Oval Fillets						3,783	5,229				

Reduced to Cases of 48 one-pound Cans

	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928
San Pedro District	5,484	5,661	3,282	255	205	3,785	5,229			10,725	359,494
San Diego District		74	9						8	118	25,349
Monterey District			34			271			268		1,030
State Totals	5,484	5,735	3,325	255	205	4,056	5,229		276	10,843	385,873

The present pack is salmon style and sells for about the same price as the cheaper grades of salmon, but is believed by many to be a superior product. The California Packing Corporation is putting out a fancy pack of fillet of mackerel in pound oval cans, both plain and with tomato sauce. This product has just been put on the market (July, 1929).

The market for canned mackerel first began growing rapidly in the southern United States, and that district is still the largest consumer.

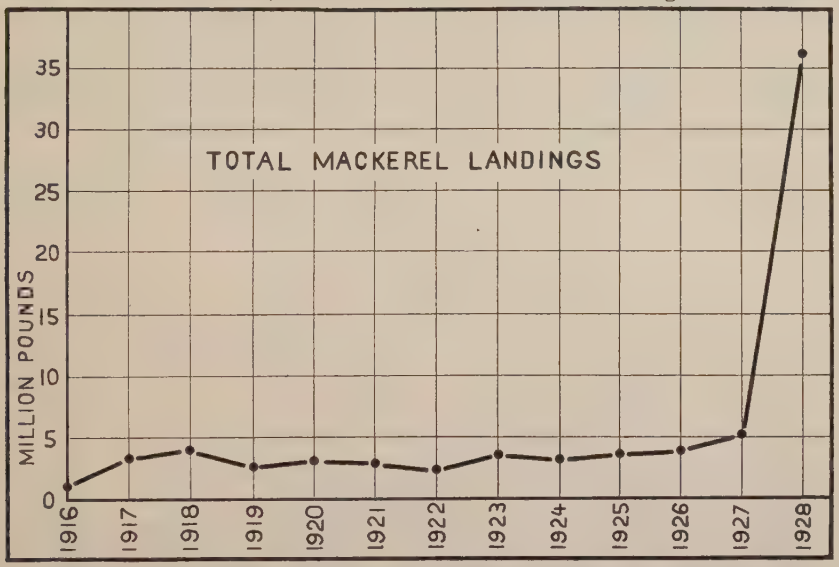

FIG. 12. Total mackerel landings in California, including horse mackerel.

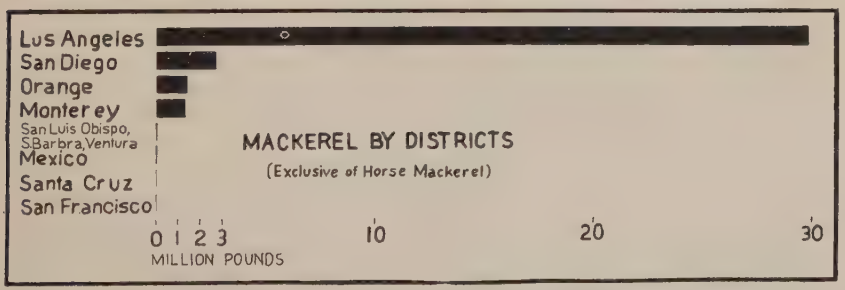

FIG. 13. Mackerel landings in 1928 by districts, exclusive of horse mackerel.

Outside the United States, Manila is the largest single receiver. (This port serves as the distribution center for the East Indies.) The Orient, France, Holland, Central and South America and South Africa also take large quantities.

The total mackerel landings of California (see figure 12) were quite low in 1916 (the earliest year of our records), but rose during the years of the war as a result of the "eat less meat" campaigns. After the war the catch dropped back considerably, and then started a slow, even rise lasting until 1927. In 1928, canning operations changed the order of magnitude of the fishery, the catch rising to nearly seven times that of 1927, the best previous year.

The 1928 mackerel landings in the various districts of the state can best be seen in figure 13. The reasons for the relative size of their catches are, in brief, as follows:

Los Angeles—Fish abundant. Six canneries operated during the height of the season. Fresh fish landings the largest in the state.

San Diego—Fish abundant. One company canned steadily. Fresh fish landings third largest in state.

Orange—Fish abundant. A large fleet of small boats landed mackerel at Newport, from which point they were trucked to the Los Angeles canneries. Fresh fish landings of little importance.

Monterey—Plenty of fish for the fresh fish markets, but not enough (1928) for the canners as well. Second largest fresh mackerel landings in the state.

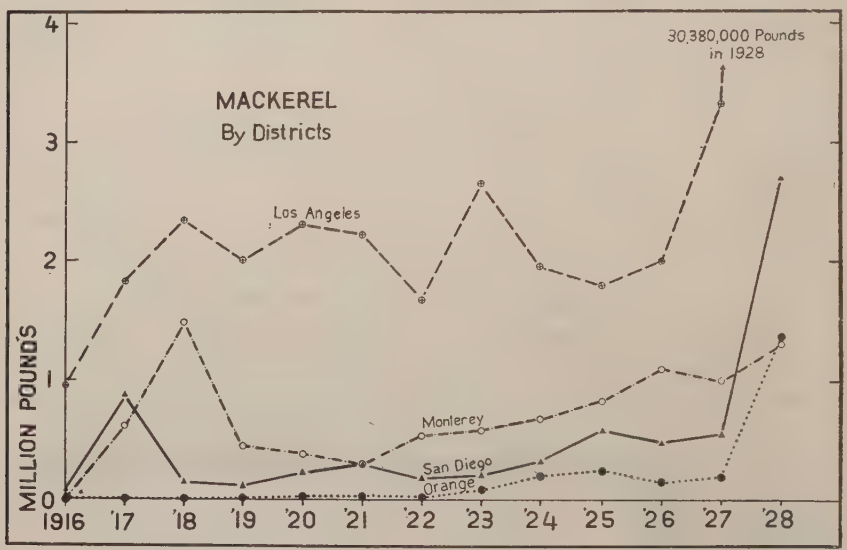

FIG. 14. Annual mackerel landings in the four principal districts, horse mackerel included.

San Luis Obispo, Santa Barbara and Ventura—These counties are rather sparsely populated and do not support a large fishing fleet.

Mexico—The Mexican export duty was over $26 a ton in 1928, and consequently no fishermen would go south of the international boundary to catch cheap fish which were abundant in California waters.

Santa Cruz, San Francisco and points north—Fish comparatively rare.

Monterey shows a tremendous wartime jump and drop in 1919, which, while marked, is not so great as the rise. A low point in 1921 is followed by a remarkably even upward trend, lasting through 1928. (See figure 14.)

San Diego had a big year in 1917, due primarily to the canning of 13,000 cases of mackerel (size of cans not ascertained), followed by a drop in 1918 which took the catch back almost to its prewar level. There was a rise with 1921 as its peak, and another greater one from 1922 through 1925, after which the catch leveled off until 1928, when

canning operations caused a tremendous jump. If the cannery fish are deducted from the 1928 catch, the curve remains fairly level through 1928. The figures, when cannery fish are excluded, for the last four years are 580,000, 470,000, 550,000, and 580,000.

Orange County landings during early years were exceedingly light, but the rapid development of Newport, both as a harbor and as a fishing port, has greatly increased the catch. Prior to 1923 the catch ranged from less than 4000 pounds in 1916 to 35,000 in 1920. In 1923 the landings jumped to 96,000 pounds and to 205,000 the year following. The next sharp rise came in 1928 as a result of the sudden canning activity in the San Pedro district. J. M. Cooper, at Newport, realized the possibility of trucking mackerel to the canneries at San Pedro. The boats operating out of Newport were small, and most of them, he believed, would prefer to land their catches locally at $25 a

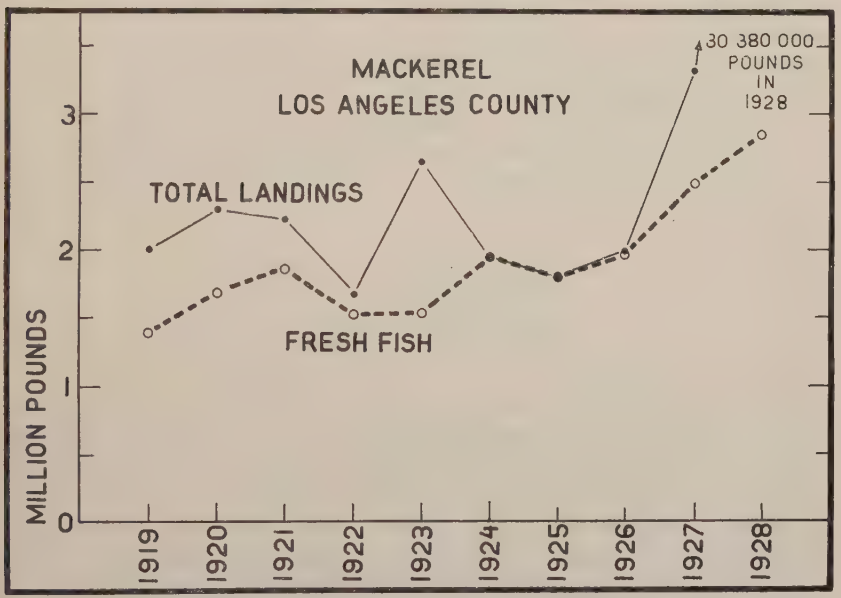

FIG. 15. Fresh fish, cannery, and total mackerel landings in Los Angeles County. The cannery catch is the difference between the other two curves. Horse mackerel included.

ton and go out after more, rather than lose several hours fishing time going to San Pedro in order to get $30 from the canners. This proved to be the case, and as a result over 1,100,000 pounds of mackerel were sent by truck into Los Angeles County during 1928.

The above described curves (see figure 14) are to all intents curves of the fresh fish catch except for San Diego County in 1917 and 1928 and Orange County in 1928. The curve of Los Angeles County, on the other hand, is greatly affected by cannery catches throughout most of its length.

In the curve for Los Angeles County (see figure 15) it will be noted that while the wartime rise is quite marked, the postwar drop is exceedingly slight, and that the trend from 1918 through 1926 is a little *downward*. In 1927 there is a decided rise, and in 1928 a jump of 600 per cent.

In figure 15 the Los Angeles catch is separated into fresh fish and total landings, the cannery catch being the difference between the two. The earliest year the cannery catch could be separated was 1919, although it is known that in 1916, 1917 and 1918 the packers received fairly large quantities of fish. The amounts probably ranged between 200,000 and 600,000 pounds.

An examination of the curve of the fresh fish catch of Los Angeles County (see figure 15) shows a rise from 1919 through 1921 and a slight depression in 1922 and 1923. The entire curve is quite smooth, and shows a fairly even upward trend.

Prior to 1923 considerable quantities of mackerel were reduced at Los Angeles canneries. It can be seen by comparing figure 15 and the table that a good deal more mackerel was received by the packers than would be required to fill the number of cases canned, especially in 1921 and 1922.

To fill a case of pound cans, from 75 to 90 pounds of mackerel are needed, depending on the size of the fish. (The waste is greater in the case of small fish.) Eighty pounds was the average of San Pedro for the 1928 season. Using this figure as a basis for calculating the amounts used in actual canning, we find that the quantity used for reduction purposes was about:

160,000 pounds in 1919
350,000 pounds in 1920
350,000 pounds in 1921
130,000 pounds in 1922

On examining figure 15 and the table, it will be noted that in 1923 the packers received 1,100,000 pounds of mackerel, and canned less than 3800 cases, a pack requiring only 450,000 or 475,000 pounds of fish. In 1924, on the other hand, they received practically no fish and packed 5200 cases. This would require between 600,000 and 650,000 pounds of mackerel. (These were both fillet packs and therefore needed about 120 pounds of fish per case instead of the usual 80.) This discrepancy is evidently due to a delay in making a canned goods report. The bulk of the 1923 catch was landed late in the year, and part of the fish was reported as canned in 1924. The 9000 cases reported for the two years account for the full 1,100,000 pounds.

The time of year at which a species of fish may be obtained in large quantities is a matter of vital importance to the canners and marketmen. In the case of the mackerel, however, the catch seems to be regulated almost entirely by the demand. The mackerel landings by months for Los Angles and San Diego counties, the two most important districts of the state, may be seen in figures 16, 17 and 18. In order to compare properly the average of past seasons with the 1928–1929 season, the monthly catches of the first two of these figures were plotted as percentages of the season's catches. To show the actual magnitude of mackerel landings before and after canning operations started, figure 18 was drawn, giving the monthly landings of 1927, 1928, and the first half of 1929, in both Los Angeles and San Diego counties.

In Los Angeles County during the past years there has been no definite mackerel season. From October to December a little more fish was brought in, but there was no period of great abundance or scarcity. The reason for this is that the supply of mackerel was infinitely

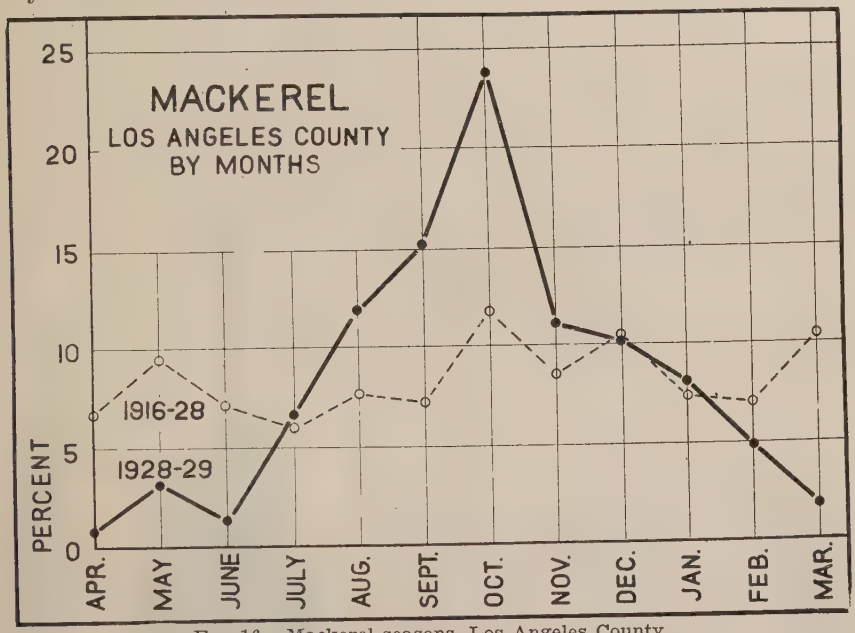

FIG. 16. Mackerel seasons, Los Angeles County.

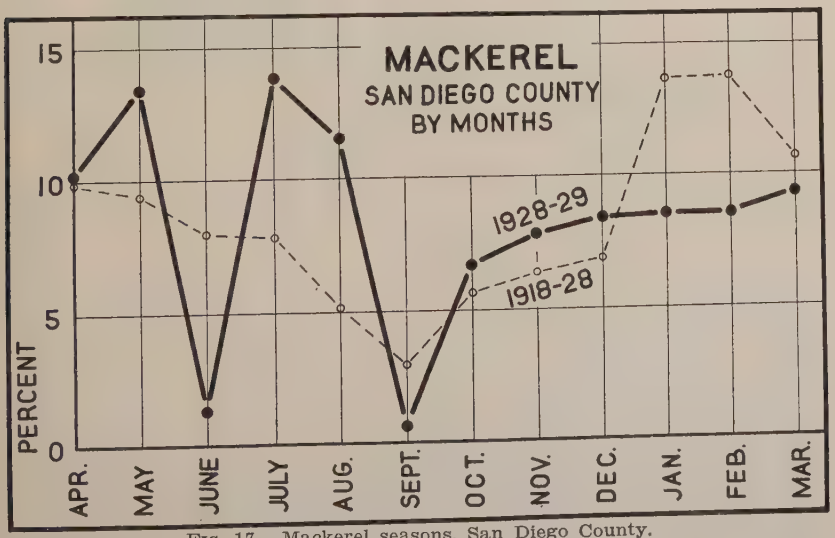

FIG. 17. Mackerel seasons, San Diego County.

greater than the demand. In the fall and winter months, higher priced fish were rather scarce and consequently mackerel were taken in their place. With the entrance of the canners into the business in 1928, matters were considerably changed. The rapid increase in the

catch from April to October was due to new canners entering the business. The drop after October is due to the opening of the sardine season. During the early part of the season, sardines were caught only during the moonless part of the night. Consequently, there was a period of a week or ten days around full moon when no sardines were caught. During this period the fishermen brought in mackerel instead. In February and March, sardines were caught in daylight as well as at night, and the packers were kept busy packing them throughout the entire month. From the end of March until the closing of the season

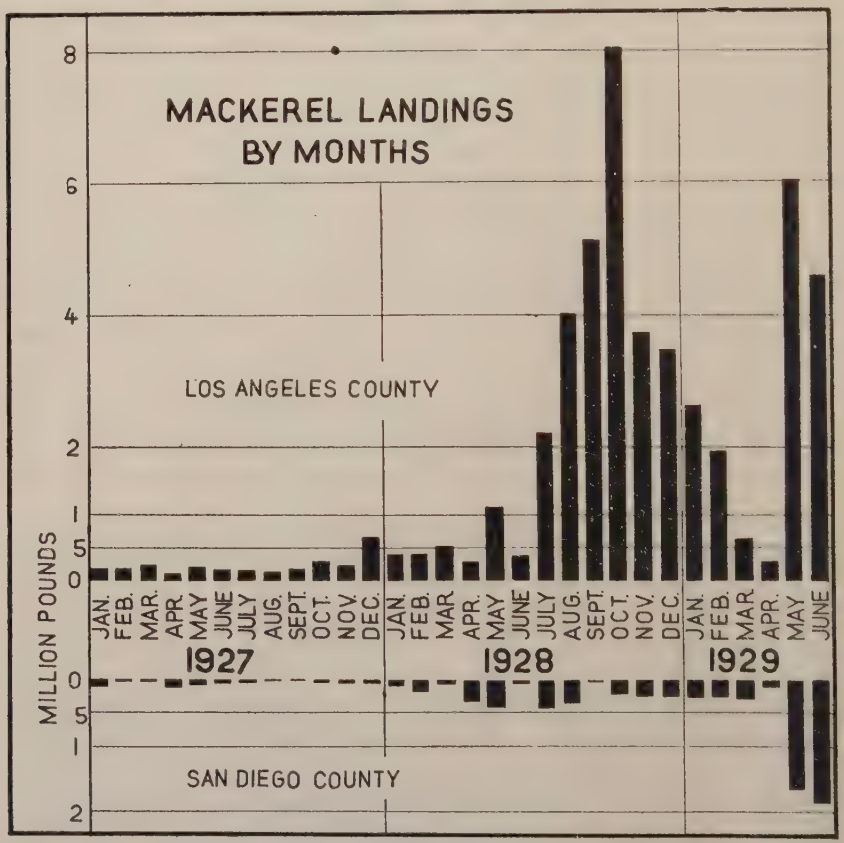

FIG. 18. Monthly mackerel landings in Los Angeles and San Diego counties, horse mackerel excluded.

in May, not enough sardines came in to keep the canners continually busy. The small mackerel catch in April (see figure 16) was due to poor fishing. The men decided it was not worth their while to go out and most of them spent the month repairing their nets. In May and June, as can be seen, fishing was considerably improved.

In San Diego County there was a fairly definite mackerel season in past years. (See figure 17.) A high point in January and February was followed by a remarkably steady decline, lasting until September. The rise after September was not quite so regular, there being a jump between December and January. The period of comparative scarcity,

lasting from August to December, was due here, as at Los Angeles, to the abundance of higher priced fish. In the April, 1928, to March, 1929, period, the two high points, May and July, were separated by a tremendous slump in June. As in former years, the lowest point was in September. The catch rose steadily from October to March, with no trace of a peak in January or February. The drop in June was due to albacore fishing. The cannery boats spent several weeks looking for these high-priced fish, but as the run failed to materialize, the fishermen finally decided that plenty of mackerel at $30 per ton was to be preferred to no albacore at $300. The drop in September was accentuated by the tuna season, which came to a peak in that month and kept the canners too busy to take any quantity of mackerel. In figure 18, it will be noticed that in May of 1929, the industry took a great spurt at San Diego. June proved to be an even better month—evidently the hope of an albacore run is being given up.

No discussion of the mackerel industry would be complete without mention of the changes in gear which have come about as a result of the entrance of the canners into the business. In former years most of the mackerel were caught by means of set lines. This method is still the practice when the fish are to be taken to the fresh fish markets. When the canners began packing mackerel, it was only natural that the boats which had been supplying them with sardines should enter this new business as well. During the sardine season, many of these boats caught mackerel with their sardine nets. Usually the purse-lamparas were used. True purse seines, while highly satisfactory for sardines, proved to be too heavy for successful mackerel fishing. The mackerel run in smaller schools, and as a purse seine requires at least an hour for a haul, not enough of these schools could be taken to make the business a paying one. The purse-lamparas, which are far lighter, can be hauled in about half an hour. The smaller sardine boats prove to be the best for mackerel, and many boats which were too small to fish sardines profitably have entered the mackerel business. At the close of the sardine season, most of the fishermen who planned to use their purse-lamparas on mackerel removed the bags of these nets and substituted two-inch mesh for the one-inch used on sardines.

In connection with their nets, some fishermen use live bait to attract the schools of mackerel and keep them around the boat, while others prefer to grind up part of a previous catch and use this "chum" to attract more mackerel. Many boats are now using hook and line with live bait. This method seems to be more successful than set line fishing.

In disposing of their catch, the net boats sell to the canners and most of the hook and line outfits to the fresh fish markets. The fresh fish markets will pay, on an average, about twice cannery prices for line-caught fish, but usually refuse to accept net catches, because the rough treatment generally bruises the fish sufficiently to impair their keeping qualities. This is not as important to the cannery, because there the fish are cooked a few hours after their arrival. Some hook and line boats of the live bait type which make large catches, prefer to deliver them to a single cannery, rather than unload a box or two at each of half a dozen markets.

In discussing mackerel fishing methods, it must be remembered that gear and catch handling, like everything else connected with the industry, is in a period of rapid change. The fishermen are constantly

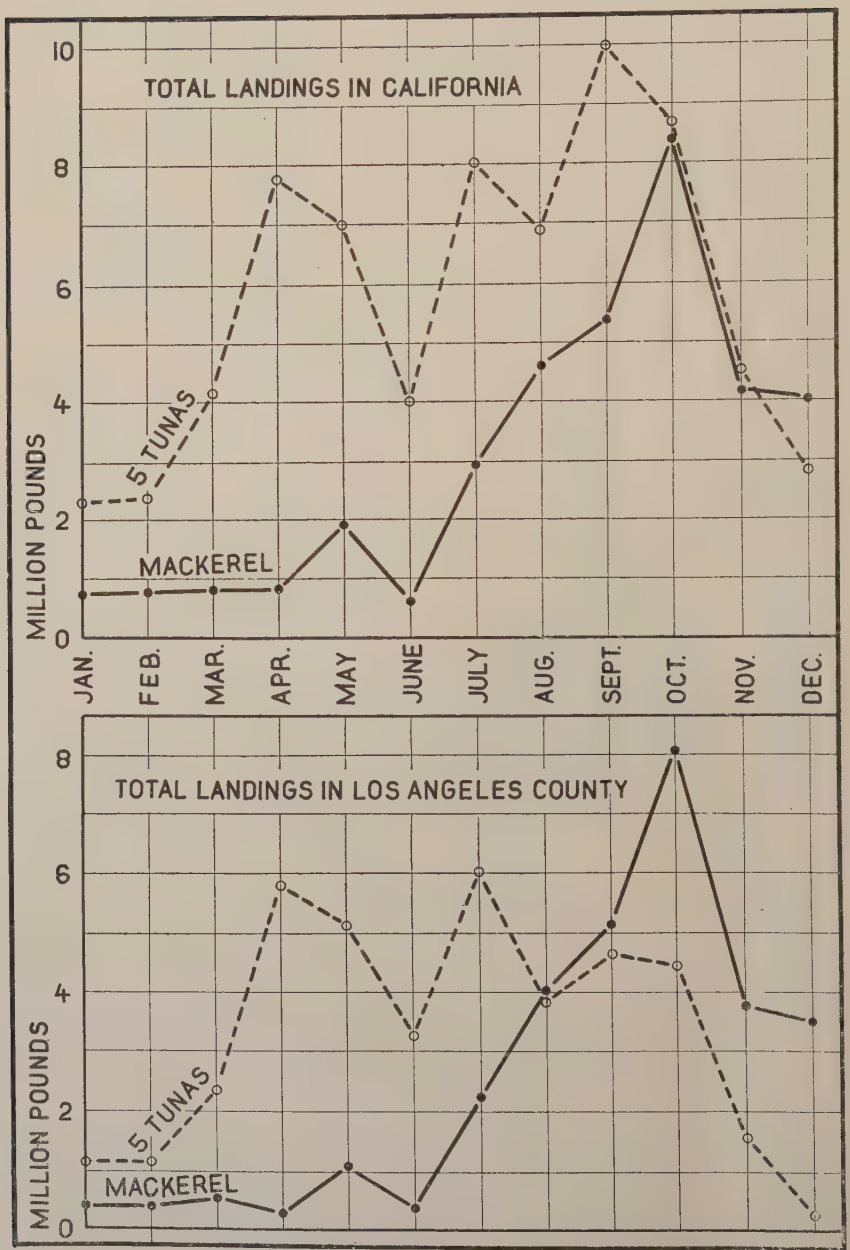

FIG. 19. A comparison of the mackerel and tuna industries in 1928.

experimenting, and the canners are continually changing their demands so it will probably be at least two or three years before there is anything approaching standardization.

This young industry has been growing at a tremendous rate. In 1927, it was a fishery of minor importance. In 1928, it was a strong rival of the tuna and is still growing. In figure 19, the combined landings of all species of tuna have been plotted with the mackerel catch for both Los Angeles and the entire state. When examining these curves, it must be remembered that the tuna industry is divided between Los Angeles and San Diego. Mackerel canning during 1928 was done on a large scale only at Los Angeles. In 1929 the industry seems to be starting a period of rapid development at San Diego, and at Los Angeles more mackerel than ever are being landed.

Last year new canneries were entering the business. This year those same canneries, having found it profitable, are rapidly increasing their capacity. The principal question with regard to mackerel used to be: What can we do to develop this huge resource? Now it is: Will the supply stand the strain?

SHAD, STRIPED BASS AND SALMON

By G. H. Clark

The principal commercial fisheries of the San Francisco Bay and Sacramento-San Joaquin river districts (Solano, Yolo, Sacramento-San Joaquin, Alameda, Contra Costa, San Francisco, San Mateo and Marin counties) are the shad, striped bass and salmon. These three species have a close relationship to each other because in the rivers and bays they are caught by the same fishermen, using the same type of gear (gill nets). The salmon, credited to San Francisco and Marin counties, however, are ocean-caught fish and will be treated later. The interrelationship of these species is so close that a rise in price in one fishery, causing increased effort to secure that kind of fish, will directly affect the catch of the other two species. Fluctuations of this sort have an important bearing on any investigations of these fisheries by means of daily boat catches.[1] Therefore, it must be borne in mind that this relationship occurs in any discussion of these fisheries from the above geographical districts.

SHAD

The shad (*Alosa sapidissima*) was first introduced into California by a shipment of 12,000 fry taken from the Hudson River in New York.[2] These fish were planted in the Sacramento River near the town of Tehama by the California Fish and Game Commission in 1871. In 1873 the United States Fish Commission liberated a second lot of 35,000 fish, and subsequent plants aggregating 609,000 shad were made by the United States Fish Commission into the Sacramento River from 1876 to 1880. From this comparatively small beginning the shad have distributed themselves along the Pacific coast line from San Pedro, in southern California, to southeastern Alaska.

The dealers in California separate the shad catch into three classes: (1) when no distinction of the catch is made the fish are termed "unclassified." During the spawning migration the shad are classified as (2) roe shad (female fish), and (3) buck shad (male fish). A much higher price is paid for the females because the shad roe is highly prized as a delicate food. Over a period of thirteen years, the proportion of these classifications in the total shad catch from the San Francisco Bay and river regions is about the same each year. Of course there are fluctuations from year to year, but the average for the thirteen years is: 12.4 per cent (of total catch) unclassified, 30.5 per cent buck, and 56.8 per cent roe. In this discussion of shad, the total catch is used, that is, all three groups are added together. However, in this connection it might be well to mention that in any future work where samples of the commercial shad catch are taken into consideration the fact that the roe shad bring a much higher price than the other groups, might have a very significant bearing on any biological or statistical results that may be obtained.

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[1] Craig, Joe A. Catch figures and fish supply. California Fish and Game, Vol. 4, No. 1, p. 37, 1928.

[2] Nidever, H. B. Shad in California. California Fish and Game, Vol. 2, No. 2, p. 59, 1916.

The shad fishery in California is carried on almost entirely around the San Francisco Bay and adjacent river localities. The catches that are made outside of these regions amount to very little, not more than 2000 pounds, and usually not over 200 pounds per year. Shad are fished for exclusively with drift gill nets, the same nets being used to capture striped bass. The fishermen of the region who operate gill nets fish for shad, striped bass and salmon; for shad and striped bass they use 5½-inch mesh nets, and in addition they may have a 6½-inch to 7½-inch mesh net for the large buck shad. The fishermen may possess a salmon gill net which is usually from 7½-inch to 10-inch mesh. The gill netters use small power boats usually manned by 2 fishermen. In 1927, there were approximately 650 gill nets employed in taking shad, striped bass and salmon, operated by about 570 fishermen using nearly 310 boats.

The shad is an anadromous fish which spends part of its life in the ocean and runs into the bays and rivers to spawn. The San Francisco Bay and adjacent river regions seem to be advantageously suited to the

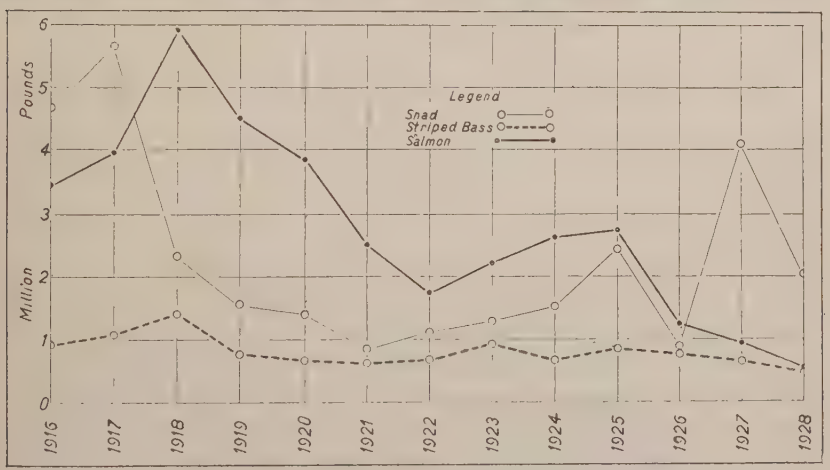

Fig. 20. Yearly catches of shad, striped bass and salmon from the San Francisco Bay and Sacramento-San Joaquin River districts.

shad for they have increased to larger numbers since their introduction into these waters. Several thousand shad were taken in San Francisco Bay district in 1877, just six years after the first planting.[2] In 1886, it was estimated that 1,000,000 shad were taken in the state. During 1915, there were 33 car loads of fresh shad shipped to eastern markets, and in addition 4,000,000 pounds of fish were consumed locally besides 700,000 pounds of shad roe. This last estimate seems too high, and probably should be cut in half to be nearer the correct catch. The total yearly catch of shad for the San Francisco Bay and river regions (see figure 20) shows a decrease of alarming rapidity from 1917 to 1921. From 1921 to 1928, the trend of the total catch is upward. The low point in 1921 is very likely caused by the economic slump after the war, as many of our fisheries curves show the same fact. The decrease in 1926 is due to a fishermen's strike which lasted from the middle of April to the last of May, which was during the height of the shad season. From this explanation of the 1926 catch, it is readily seen that

the curve in figure 20 does not show the true state of the fishery. (See footnote 1.) Most certainly legal restrictions passed in 1918 protecting the spawning shad, have had an influence on the upward trend since 1921. No concentrated investigation of the shad catch has been

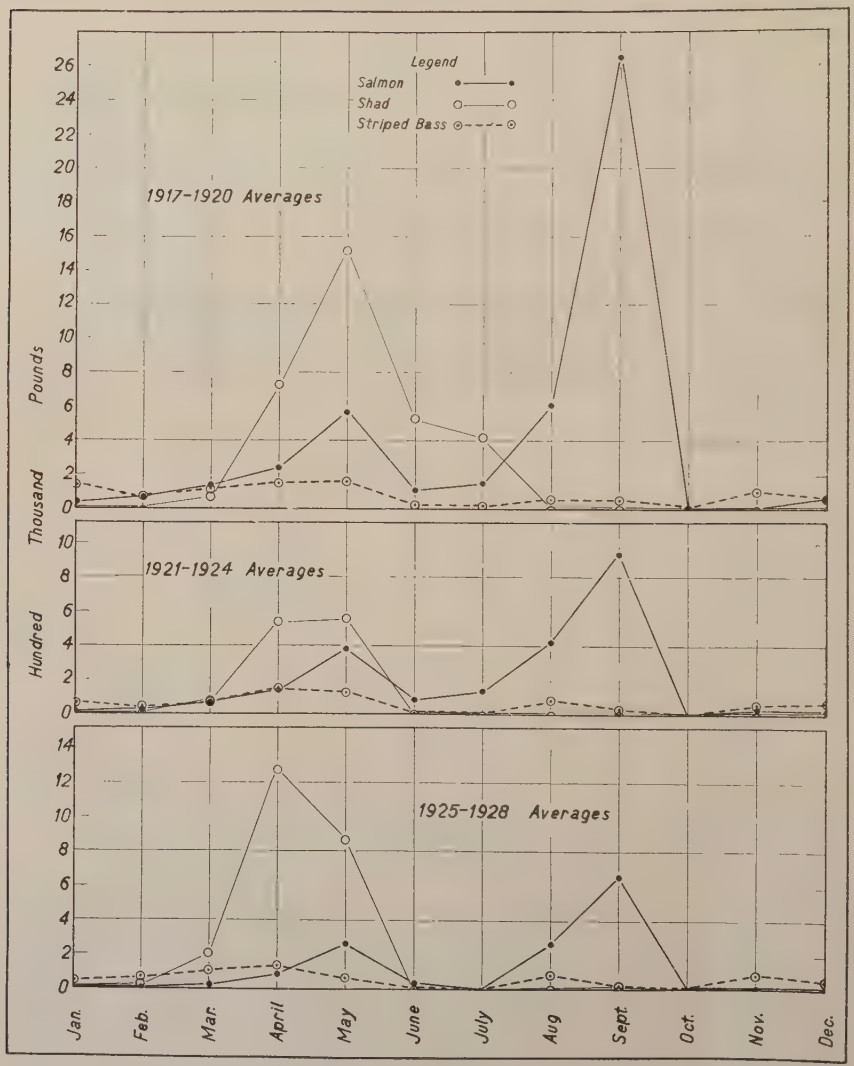

FIG. 21. Monthly averages of salmon, shad and striped bass catches from San Francisco Bay and Sacramento-San Joaquin River districts for four-year periods. The graph affords a comparison of the three fishes—the average per month in relation to each other and any variation in seasons.

attempted to determine the exact status of the fishery. However, a preliminary boat catch analysis has been made and while the results are not conclusive, it would seem that the average boat catch is steadily increasing. (See footnote 1.) The largest shad catches are made from March to June (see figure 21), very few fish being taken in any of the

other months. Figure 21 shows the average monthly catch in four-year periods from 1917 to 1928. It will be noticed that there is no change of season for shad throughout the periods used in the monthly averages. Figure 22 gives the monthly catch for 1928 of the three species. The season for shad is the same (March, April and May) as in the average curves.

Attention is directed to figures 21 and 22, where the great differences in the monthly magnitude of the catches of the three species are shown. At times, shad and salmon run into a million or more pounds per month, while the striped bass never go over 200,000 pounds for a month.

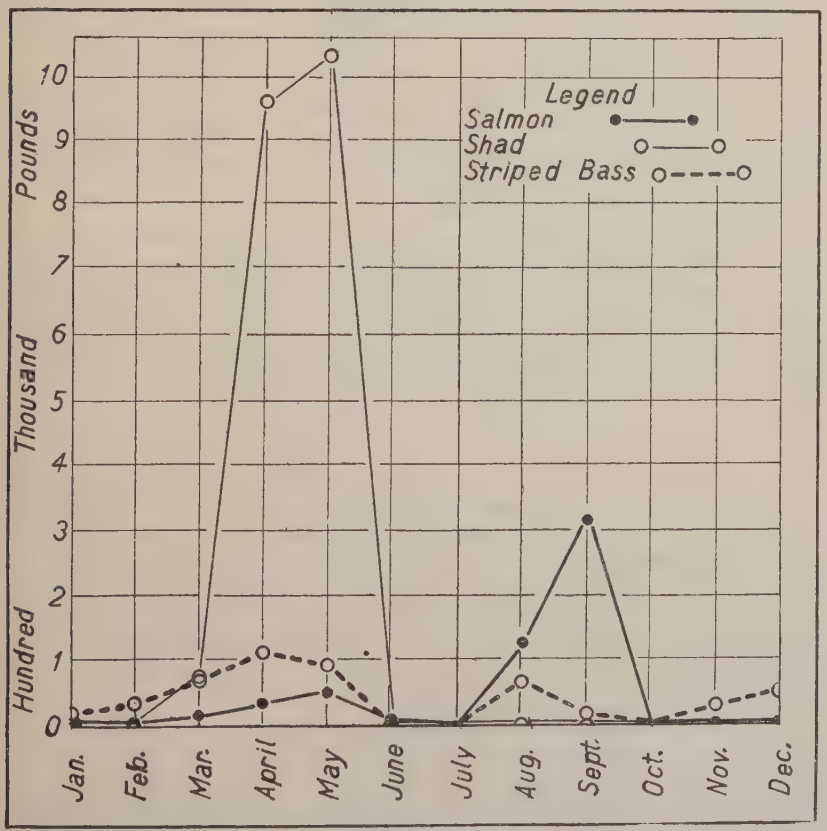

FIG. 22. 1928 salmon, shad and striped bass catch by months from the San Francisco Bay and Sacramento-San Joaquin River regions.

STRIPED BASS

The striped bass (*Roccus lineatus*) was introduced into California from the eastern coast in 1879, when a planting of 135 small and middle-sized fish were liberated in Carquinez Strait at Martinez.[3] A second and final plant was made in 1882, when about 300 fish were put into Suisun Bay near Army Point. From these two plantings of 435 fish, our striped bass population has developed, and also from this stock

[3] Scofield, N. B., and Bryant, H. C. The striped bass in California. California Fish and Game, Vol. 12, No. 2, p. 65, 1926.

efforts were made to transplant the striped bass in other waters of California. These attempts have been partially successful, but the fish have not thrived and reproduced as they have done in San Francisco Bay and the Sacramento and San Joaquin rivers. The range of striped bass on the Pacific coast is from San Diego to Coos Bay, Oregon. However, the largest amounts of this species are caught in San Francisco Bay and adjacent river localities. Very few striped bass are taken in California outside of this region, only a few being caught in Mendocino County and in Monterey Bay.

The striped bass are caught in the same gill nets that are used for shad, which are usually of a 5½-inch mesh, by the same fishermen using the same boats. The striped bass catch from 1916 to 1928 (see figure 20) has been fairly constant. Fluctuations from year to year have occurred due to natural causes or to restrictive legislation, cutting down the fishing areas and seasons, but taken as a whole the fishery is one of steady productivity. The catches in 1927 and 1928 are somewhat lower than those in previous years, but this is due to legislation which cut down the fishing areas in 1927.

Striped bass are taken in almost every month of the year except during closed seasons. The height of the season occurs in March, April and May, and another but lower height comes during August and September. October is a closed month, but the catches of November, December and January almost equal those of August and September. (See figure 21.) There has been no change of season except by legal closing of fishing time since 1917, as can be seen from figure 21 (of the monthly averages in four-year periods). Figure 22, showing the monthly catch for 1928, portrays the same seasons as are mentioned above.

The law requires that no striped bass shall be taken under 20 inches in length commercially or under 12½ inches by anglers. Protective measures to conserve the striped bass fishery have been wisely passed by the legislature restricting the fishing areas and seasons. (Laws regulating striped bass also apply to shad, except size limits, because the two fisheries are so closely related.) As a result of these legal measures the striped bass fishery is on a firm foundation and there is every evidence that the supply is on the increase.[4]

SALMON

The salmon fishery consists almost entirely of the king salmon (*Oncorhynchus tschawytscha*) with a few silver salmon (*Oncorhynchus kisutch*). The industry is one of the oldest fisheries of the state and is now carried on in both river and ocean districts. Figure 23 gives the catches of salmon by districts for 1928, separating the river from the ocean-caught fish. As has been the case for the last few years, the total ocean catch has surpassed the aggregated river catch. (See figure 23.)

The Sacramento River salmon fishery was among the first of the commercial fisheries in California; starting about 1850, it has been carried on to this day.[5] The gear and fishermen have been mentioned

[4] Craig, Joe A. The striped bass supply of California. California Fish and Game, Vol. 14, No. 4, p. 265, 1928.

[5] Clark, G. H. Sacramento-San Joaquin salmon (*Oncorhynchus tschawytscha*) fishery of California. Division of Fish and Game of California, Fish Bulletin No. 17, 1929.

above in the discussion of the shad and striped bass industries. The salmon of the Sacramento River are depleted as is shown by the falling off of the egg-takes in the river, reduction of spawning fish caused by the cutting down of spawning beds, and the rapid declining commercial catch. (See footnote 5 and figure 20.)

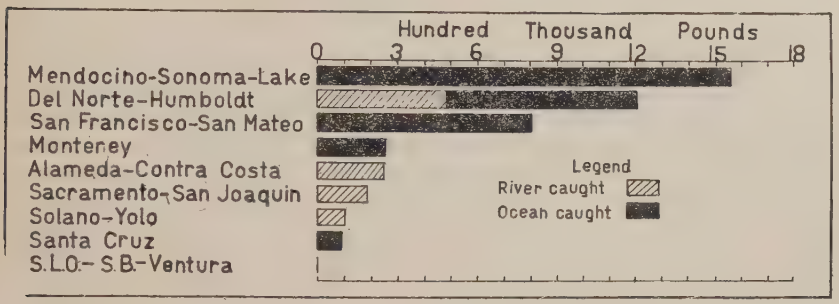

Fig. 23. Salmon catch by districts for 1928, showing river and ocean-caught fish.

Besides the Sacramento River, three other rivers in California have supplied salmon to the markets and canneries. The Eel River from 1916 to 1921 had a fluctuating catch producing almost a million pounds in the high years. (See figure 24.) The river was closed to commercial fishing in 1922. Mad River was fished commercially for one year, 1918, and produced about 68,000 pounds of salmon.

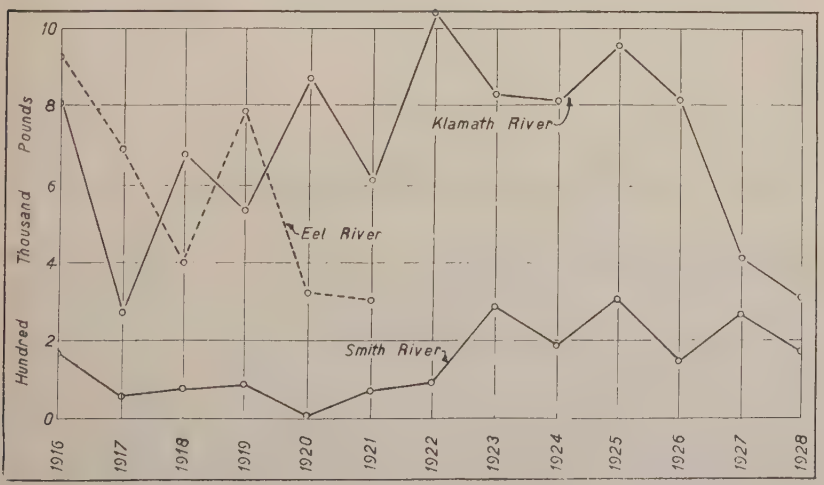

Fig. 24. Yearly salmon catches for Klamath, Smith and Eel rivers from 1916 to 1928.

The Klamath River has been a fairly constant salmon stream (see figure 24) with a steadily increasing catch from 1916 to 1925, although in the last few years the catch has fallen off.

Smith River produces a smaller annual catch than the Klamath, but it has been increasing each year from 1916 to the present time, 1928. (See figure 24.)

Ocean Fishing.

Ocean trolling for salmon started at Monterey Bay as a sport as early as 1893. Gradually, the fishermen began to catch larger quantities of the fish and to make a commercial industry of the sport. For a long time salmon trolling was confined to this locality, but later the activities spread to the waters outside of San Francisco Bay.

In the early days of trolling, sail boats were used exclusively. By 1915 most of the sail boats were replaced by gas motor boats. In 1915 all the large fish were mild cured and the smaller fish were sold fresh. In this year (1915), 330 salmon fishermen at Monterey formed a union to keep the price up to 4 cents a pound. In 1916, the number of salmon fishermen at Monterey increased to 400 or 500. When power boats came into use the salmon trolling advanced northward since it was now possible to go from one fishing center to another where the fish might be more abundant. In 1917 there were 100 boats fishing out of Fort Bragg along the Mendocino coast. The following year the number of boats in this vicinity was doubled.

By 1921 the sea trolling for salmon had become so profitable that there were about 500 fishermen at each of the fishing centers of Monterey, San Francisco and Fort Bragg, who were engaged in this type of salmon fishing. In 1922 the fishery had spread as far north as Shelter Cove and Eureka. The next year (1923) salmon trolling was carried to Trinidad and around the mouths of the Klamath and Smith rivers.

The boats used in the ocean fishery are usually of the clipper bow type equipped with a one- or two-cylinder gasoline motor. Such boats are manned by one or two fishermen who operate the boat and fish at the same time. The boats leave port early in the morning and troll all day, returning in the late afternoon or evening to deliver their catches.

The salmon are caught on troll lines that extend from outriggers hinged to the mast and from lines trolled from the stern.[6] The lines are trolled at various depths held in position by lead sinkers. Each line has several leaders with spoon hooks attached at various depths. The fishermen haul each line in at intervals while trolling and remove the salmon from the hooks. Bait is used by some of the fishermen.

The total catch curves of salmon in the ocean point toward depletion in the troll fishery, but total catch curves alone are uncertain indicators of the population of a fishery, so too much faith can not be placed in the curves. The complexities of the salmon fishery on the Pacific coast make it very hard to determine just what its status may be. In most cases of ocean-caught salmon, the total catch curves are not an index to depletion in any one district because the fish have a large range from Monterey to Alaska, so that in ocean fishing we have not as yet any clear conception with what native river populations we are dealing. Disregarding all but California landings, we have in figure 25 the total catch curves from 1916 to 1928 of the geographical districts. The Monterey Bay curve shows a sharp decrease from 1916 to 1928. In 1926 the catch amounted to only 50,000 pounds; however, the year was unusually poor for all salmon catches on the entire Pacific coast. Depletion has undoubtedly occurred in the Monterey Bay salmon fishery, judging by the decline in total catch during the years when

[6] Scofield, W. L. Gear used for salmon trolling in California in 1920. California Fish and Game, Vol. 7, No. 1, p. 22, 1921.

the number of fishermen engaged was increasing. Monterey Bay, being the first place where salmon trolling was carried on, had reached its high point by 1916 (at the time our statistics were first gathered) and would naturally show a decline before it became apparent in the catch curves for the other districts.

The total catch for San Francisco and Marin counties (the figures being added together) shows no such steep decline as that of Monterey Bay. (See figure 25.) Instead, discounting yearly fluctuations, the trend of the curve is about horizontal from 1918 to 1928. From 1916 to 1918, the fishery was getting a foothold as a new industry in the locality; from 1918 to 1921 the catch went down and then up again to a very high point in 1924. This peak is inexplainable but perhaps is due to higher prices paid in the vicinity, or more fishermen engaged in

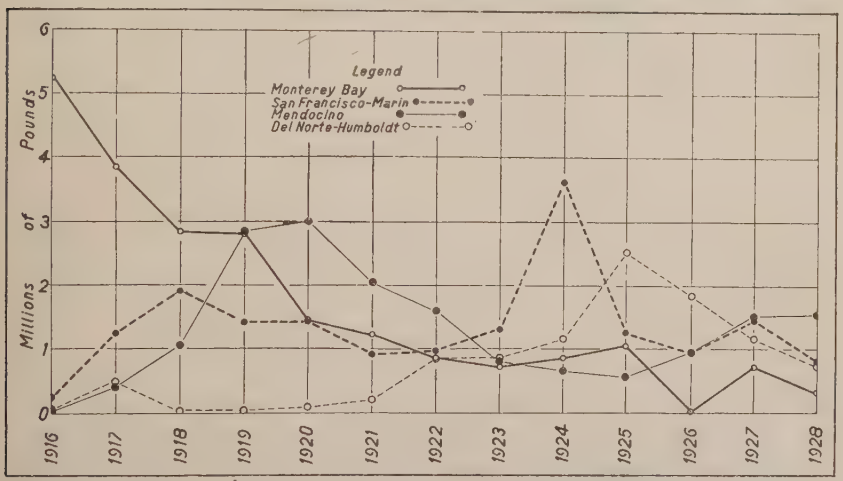

FIG. 25. California ocean-caught salmon by geographical districts—Monterey Bay (Monterey and Santa Cruz), San Francisco-Marin, Mendocino, and Del Norte-Humboldt.

salmon fishing. It may merely have been that the salmon and their captors happened to meet at the right time. The San Francisco and Marin catch curve for a period of thirteen years has remained the most steady in total catch of salmon.

The salmon catch of Mendocino County in its early years, 1916 to 1920, gradually increased as the fishery gained position in the northern part of the state. (See figure 25.) From a total of 3,000,000 pounds in 1920 the catch has fallen off to 500,000 pounds in 1925, but has increased since then to 1,500,000 pounds in 1928. What the causes of the decreases and the later increases are has not been determined.

The ocean trolling off Eureka and to the north is the latest salmon fishery to be developed in the state, and it will be noticed that it was not until 1922 that catches from this vicinity were very large. (See figure 25.) (The high catch from Eureka in 1917 is perhaps caused by fish taken in Eel River and recorded erroneously as ocean-caught.) The high point in this district came in 1925, but since then the curve has steadily declined to a low point in 1928. The curves for each district in which ocean trolling is carried on do not show the true trend

of the sea fishery as a whole because of the differences in the many districts. However, in figure 26 the combined catches made in the ocean each year are plotted and there is a downward trend in this curve, which is not steep: but the fishery seems to be decreasing. It may be that a closer investigation through an average daily boat catch analysis of the ocean catches will reveal that the fishery is being rapidly depleted.

Numerous controversies concerning the seasons of salmon in different localities have been coming up for a number of years. Fishermen and dealers claim that the salmon are more abundant earlier or later and endeavor to get legislation to lengthen the season or open it earlier. Overfishing of a species in a given locality naturally will be noticed first at the beginning and at the end of the run so that it would appear that the season began later, where in reality it covers the same period as formerly. Figure 27 has been prepared to show the seasons of salmon from the different districts over a period of twelve years by a monthly average at four-year intervals. Attention is directed to the

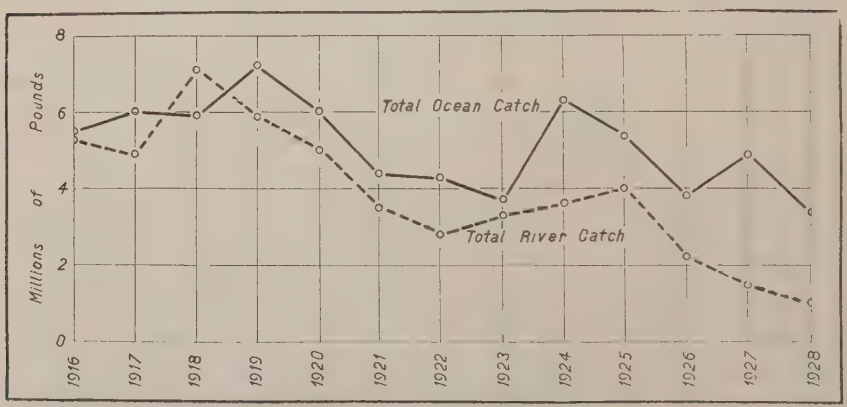

Fig. 26. Yearly total ocean catch compared with total river catch of salmon from 1916 to 1928, inclusive.

figure showing these periods. Monterey Bay (Monterey and Santa Cruz catch) has had no change of season since 1917, for the four-year average curves fall directly under each other.

The curves for San Francisco and Marin counties do indicate some change in season. The main catches from 1917 to 1920 were during July, August and September, while the average monthly catch from 1921 to 1924 came in June, July and August, and the recent period, 1925 to 1928, shows the main catch from May to September. The shifting of the season in this locality is perhaps due to the fact that the Monterey Bay boats moved north to San Francisco in search of better fishing earlier in the season as the fish became less abundant in the vicinity of Monterey. For instance in the 1921–1924 period, the fishing in Monterey Bay was poorer late in the season than it had been the previous period (1917–1920), so naturally the boats sought better fishing grounds sooner and therefore caught salmon off the Golden Gate earlier. The same may be true for the next period of years.

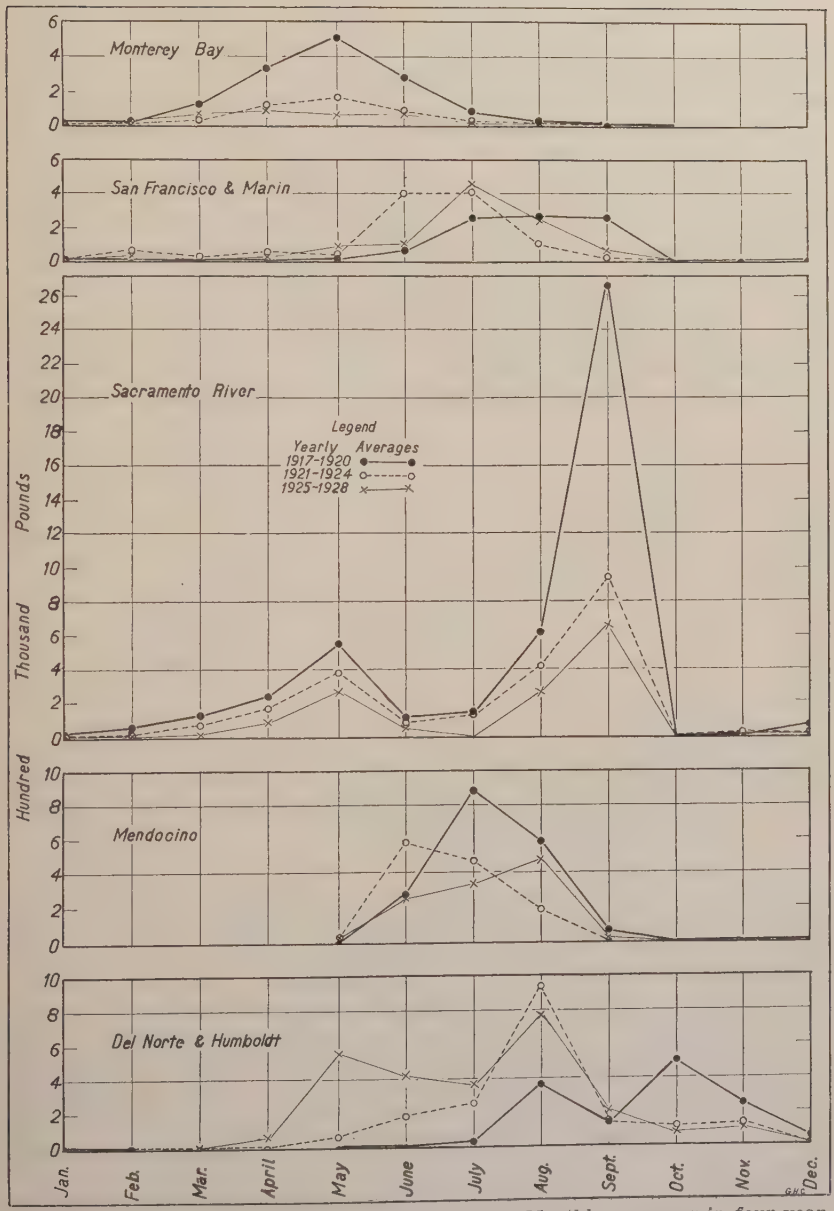

FIG. 27. Salmon catch by geographical districts. Monthly averages in four-year periods from 1917 to 1928, inclusive.

The Sacramento River salmon season has not changed a particle in the twelve years under consideration. The catches have fallen off to an alarming extent each period, but the seasons have remained the same. These curves should put an end to the long standing controversies on seasons in this fishing district.

The salmon season along the Mendocino coast has not changed noticeably in the twelve years (1917–1928). The high months have varied from period to period, but the catches have all been confined to the months from May to September.

The curves for Del Norte and Humblodt counties present more complexities than those for the other localities as the figures include the ocean fish, Klamath River fish and Smith River catches. It is regrettable that the river catches could not be separated from the ocean landings because in the present method of handling the state's salmon statistics, the monthly figures for the rivers are not separated from the ocean catches in the tabulations. In the monthly average curve for the 1917–1920 period (see figure 27) it will be noticed that the main catches were made from June to December. These figures are almost

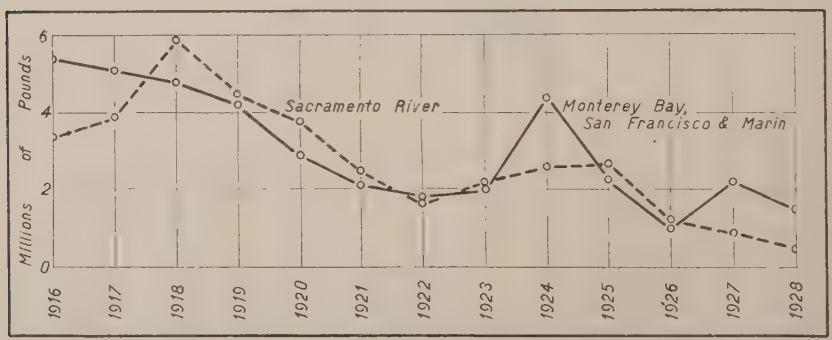

FIG. 28. Sacramento River salmon catch compared with ocean catch of Monterey Bay plus San Francisco and Marin County catches for a thirteen-year period, from 1916 to 1928, inclusive.

entirely records of fish from the Klamath and Smith rivers. The 1921–1924 curve shows a shifting of the season beginning in May and continuing through to November. This change of season is due to the introduction of ocean trolling in the locality around Eureka about 1921. The high point in August is the combined Klamath River and ocean catch, while the catch from September to November is from Smith River. The 1924–1928 curve is explainable in the same manner. The early catches from March to July are entirely ocean fish, while the catches from July to September are a combination of the Klamath River and ocean fish, and from September to November are Smith River catches.

The salmon catches in California from all appearances are decreasing. Depletion of the Sacramento River salmon is evident. (See footnote 5.) Such conclusive evidence of depletion is not at hand for the other rivers in California. However, if we are to judge the ocean fishery of California as being made up of the salmon native to rivers in California, the ocean catch should decrease as the river catches do

(see figure 28), or perhaps the influence works the other way: the river landings decrease as the ocean catches fall off. Whichever way we look at it, the total salmon catch for the state is getting smaller, and we believe that curtailment of ocean trolling will materially help the situation. However, the limiting of ocean trolling is a big order, and perhaps can not be successfully effected unless the three Pacific coast states and Canada all agree to the same terms for controlling the fishery.

WHITE SEA BASS

By S. S. Whitehead

As far back as we have any authentic records, white sea bass have been caught commercially in fairly large quantities. Until 1915 most of the white sea bass were taken by gill nets. In 1915 purse seines were introduced into southern California which were very successful, and until 1924 played an important part in the white sea bass fishery both locally and in Mexico.[1] It was not until the introduction of the purse seine that the Mexican sea bass fishery on the west coast produced any large amounts. After 1924 the local white sea bass catch depended on the gill nets and lamparas. Fishermen say that the failure to make big enough catches caused the purse seine fishermen to stop fishing white sea bass.

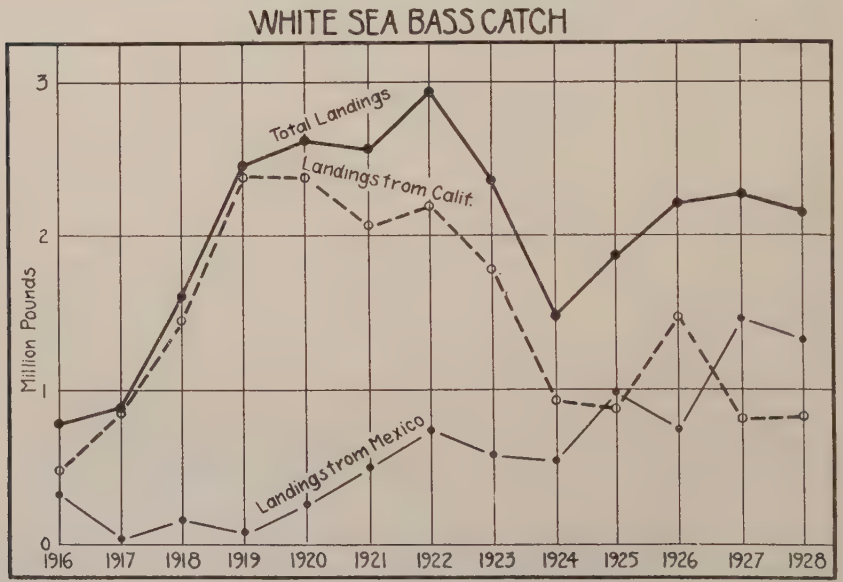

Fig. 29. Trend of white sea bass landings by years.

Until 1924 all the fish in the white sea bass catch were of one species (*Cynoscion nobilis*). In 1924 the totuava (*Cynoscion macdonaldi*) caught in the Gulf of California, Mexico, were trucked into California to the markets at San Diego and San Pedro.[2] Because the two species were similar in appearance they were both recorded as white sea bass. In 1925, 1926 and 1927, no attempt was made to separate the totuava of the Gulf of California from the white sea bass caught on the west coast of Lower California. The white sea bass records of the amounts caught on the west side of Lower California for 1925, 1926 and 1927 are in error to the extent of the totuava included with them.

[1] Skogsberg, Tage. Preliminary investigation of the purse seine industry of southern California. California Fish and Game Commission, Fish Bull. No. 9, p. 9, 1925.
[2] Chute, George Roger. Totuava fishery of the Calfornia Gulf. California Fish and Game, Vol. 14, No. 4, p. 275, 1928.

In 1928 practically all the totuava were segregated from the white sea bass of the west side except for some small amounts of totuava trucked into San Diego. For totuava importations into California in 1928, see table on page 109.

Figure 29 illustrates the annual landings in California, fish caught off the California coast and landings from Mexico. If it were not for the totuava catch there would probably not be the rapid increase in the Mexican landings since 1924. Of course the same applies to the total landings.

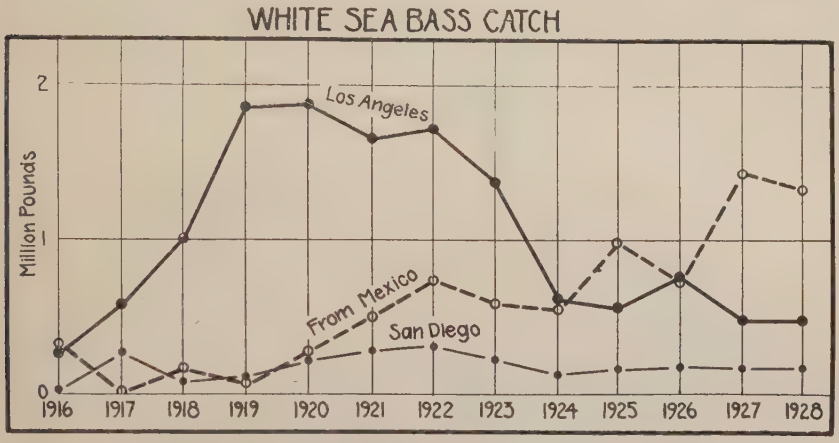

Fig. 30. Comparison of yearly landings, Los Angeles and San Diego counties, and landings from Mexico.

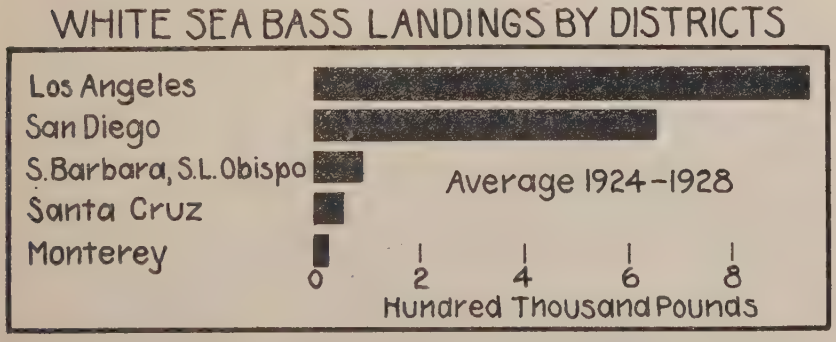

Fig. 31. Average annual landings of white sea bass by districts. Mexican landings included with San Diego and Los Angeles figures.

Figure 30 is the trend of the two districts, Los Angeles and San Pedro, compared with landings from Mexico.

Figure 31 shows the catch by districts in order of amount. Mexican landings at San Diego and Los Angeles have been included. The catches for the last five years were averaged to eliminate any minor fluctuations. If it were not for the landings from Mexico, San Diego's catch would have been approximately one-half of what it is. As can be seen from the figure, little white sea bass are landed north of Los Angeles. Some of the landings in Los Angeles County were caught around Point Conception and south around Oceanside.

There is very little difference in the local seasons at San Diego and at Los Angeles as shown by figure 32. The five-year (1924–1928) average monthly catches were plotted as a percentage of the average annual catches for each district. These figures do not represent the actual

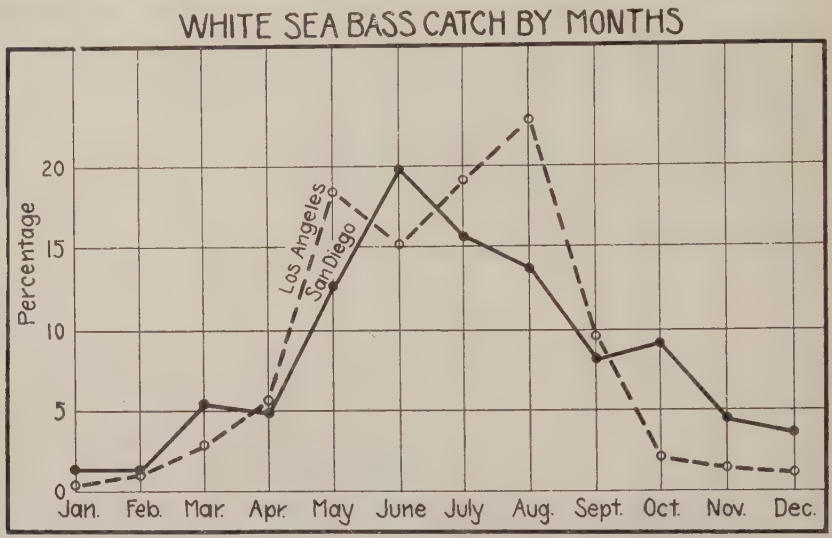

FIG. 32. Monthly catches of white sea bass expressed as a percentage of five-year average annual catch for the period 1924-1928.

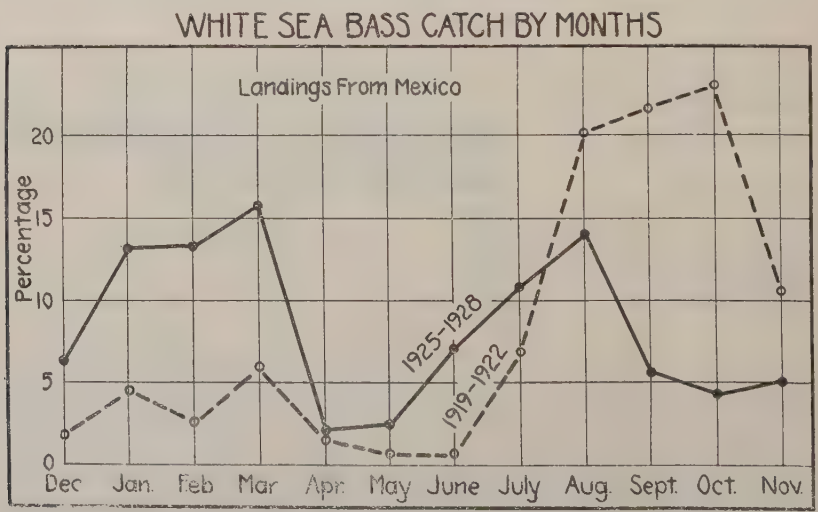

FIG. 33. Comparison of white sea bass monthly catches, 1919–1922 with 1925–1928. Monthly catches were expressed as a percentage of the total annual catch for each four-year period.

amounts landed in each district, for only about one-third as much is landed at San Diego as at Los Angeles. Landings from Mexico were not included in this comparison.

There has been a decided change in the peaks of the seasons in landings from Mexico as is demonstrated by figure 33. A four-year average

from 1919 to 1922 was compared with an average of similar number of years from 1925 to 1928. Percentages were used as in figure 32. In the early years, 1919 to 1922, big landings were made only in the fall, while from 1925 to 1928 there were two peaks, one in the winter and one in the fall. The peak in the winter of the 1925 to 1928 period is caused by the addition of the totuava, from the Gulf of California fishery, to the records, while the peak in the fall is caused by the west coast fishery composed of *Cynoscion nobilis*. Because percentages have been used there is no relation of actual amounts between the two periods. Actually a much greater amount was landed in the period 1925–1928 than in the period 1919–1922.

YELLOWTAIL

By S. S. Whitehead

The yellowtail fishery is confined strictly to southern waters, as very little is caught north of Los Angeles County. This fishery extends south off the coast of Lower California, and the landings from there have increased in the last few years.

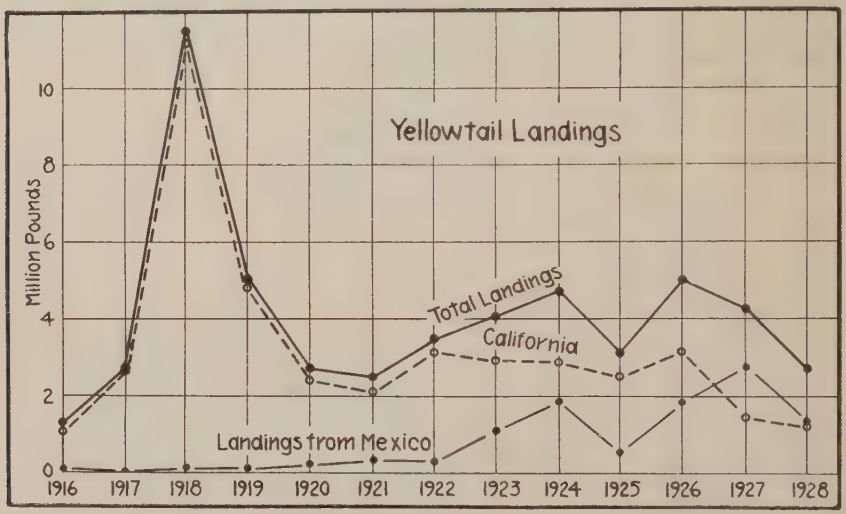

Fig. 34. Yearly trends of yellowtail landings.

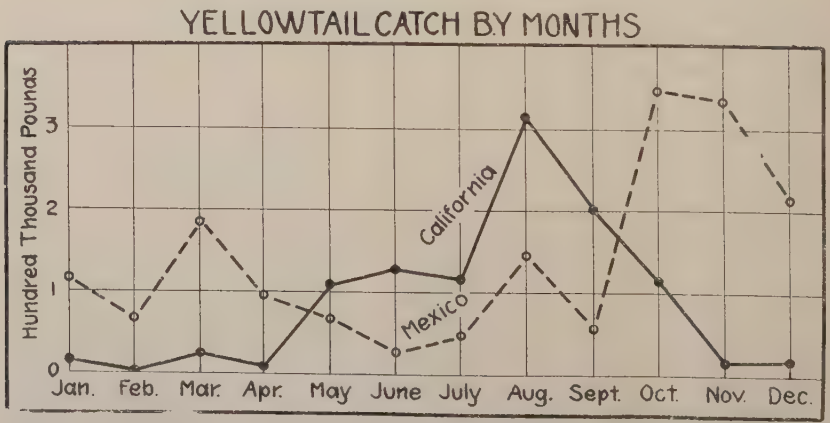

Fig. 35. Comparison of monthly yellowtail catches off the coast of Mexico for a five-year period 1924–1928, with an average of those made at Los Angeles and San Diego during the same period.

Until the advent of the purse seines in California, yellowtail were caught by small jig and live bait boats. After 1920, yellowtail were taken in increasing amounts by the purse seines, but at present large quantities of yellowtail are still caught at San Diego by jig and live bait boats.

Generally, yellowtail are consumed as a fresh fish and very few are canned. However, in 1918 a relatively large amount, 72,000 cases, was packed. Such a pack has not been duplicated since, for in 1919 the pack fell to 28,000 cases and has not reached that level since.

The big cannery pack of 1918 was also coincident with the large amount landed in that year. (See figure 34, which shows the annual landings in California from 1916 on.) Another year or so will be necessary to demonstrate whether or not the trend of yellowtail caught in California is downward. The low catches in the last two years may have resulted from minor fluctuations.

Figure 35 is a comparison of average monthly landings of yellowtail at Los Angeles and San Diego with those from Mexico. San Diego and Los Angeles were grouped and averaged because there is little difference in the peak of the seasons in these two places. An average of the corresponding months of the last five years was used to eliminate minor fluctuations.

HALIBUT

By G. H. Clark

There are two species of halibut caught in California waters: northern or true halibut (*Hippoglossus hippoglossus*) and southern halibut (*Paralichthys californicus*). As stated in Fish Bulletin No. 15, the northern range of the southern halibut is off-shore from the town of Santa Cruz, while the southern range of the true halibut is San Francisco. Halibut landed at San Farncisco in past years were of both varieties,[1] but in 1928 all the halibut landed in San Francisco were of the northern species.

NORTHERN HALIBUT

The landings of northern halibut in California for 1928 are considerably lower than in 1927. (See figure 36.) Perhaps this is due to natural yearly fluctuations as the total catch has been on an upward trend since 1925. (See figure 37.) The landings by districts for 1928 of the true halibut is shown in figure 38, and shows Del Norte and Humboldt leading with total catches aggregating over 300,000 pounds, while Men-

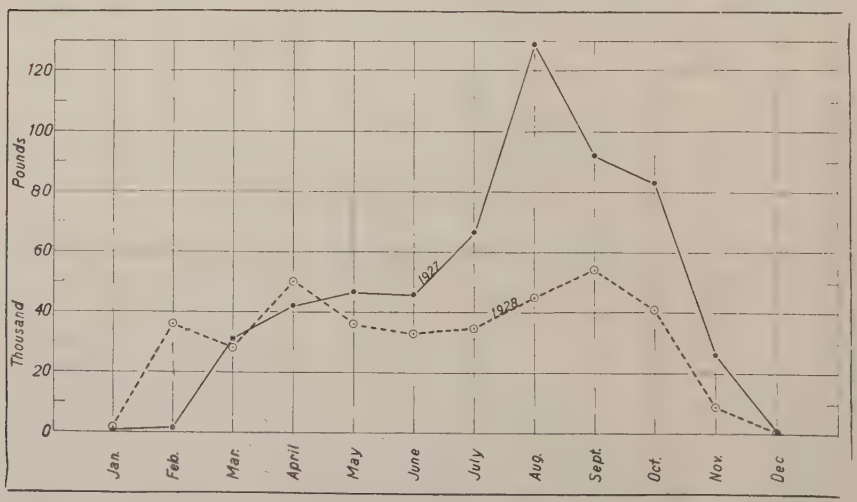

Fig. 36. Northern halibut catch by months for the state, 1927 compared with 1928.

docino, San Francisco and Marin follow in order with catches all under 50,000 pounds. Northern halibut are taken in all months of the year, the largest quantities being caught from April to November. High points for different years vary somewhat but occur either in August or September. (See figure 36.)

SOUTHERN HALIBUT

The total landings of southern halibut are on the decline (see figure 37), due perhaps to overfishing of the species and depopulating the banks of the young fish before they have had a chance to spawn. It is

[1] Whitehead, S. S. Northern and southern halibut. Division of Fish and Game of California, Fish Bulletin No. 15, pp. 35–37, 1929.

hoped by next year that a preliminary boat catch analysis and a few facts concerning the life history of this fish may be completed so that more positive information can be given about this fishery. Figure 39

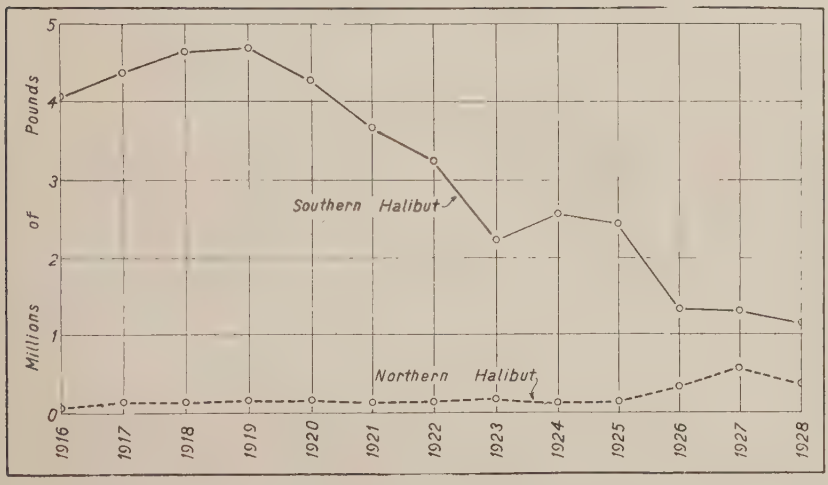

FIG. 37. Yearly landings of northern and southern halibut for California (including Mexican catches).

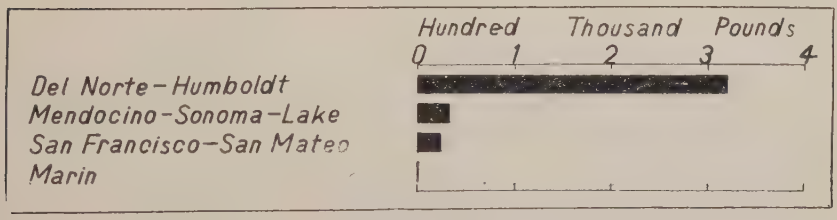

FIG. 38. 1928 northern halibut catch by districts.

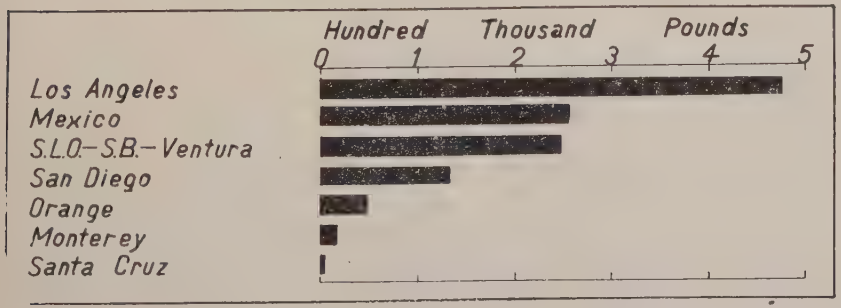

FIG. 39. 1928 southern halibut catch by districts.

shows the total catches of southern halibut by districts for 1928. Los Angeles leads with a total of over 450,000 pounds. Fish from Mexico is next with about 250,000 pounds, then in order follow San Luis

Obispo-Santa Barbara-Ventura, San Diego, Orange, Monterey and Santa Cruz. The local catches in California are made through the entire year but the peak comes in March with a falling off after that date. The catches from the west coast of Mexico occur all year with a high point in July or August. (See figure 40.)

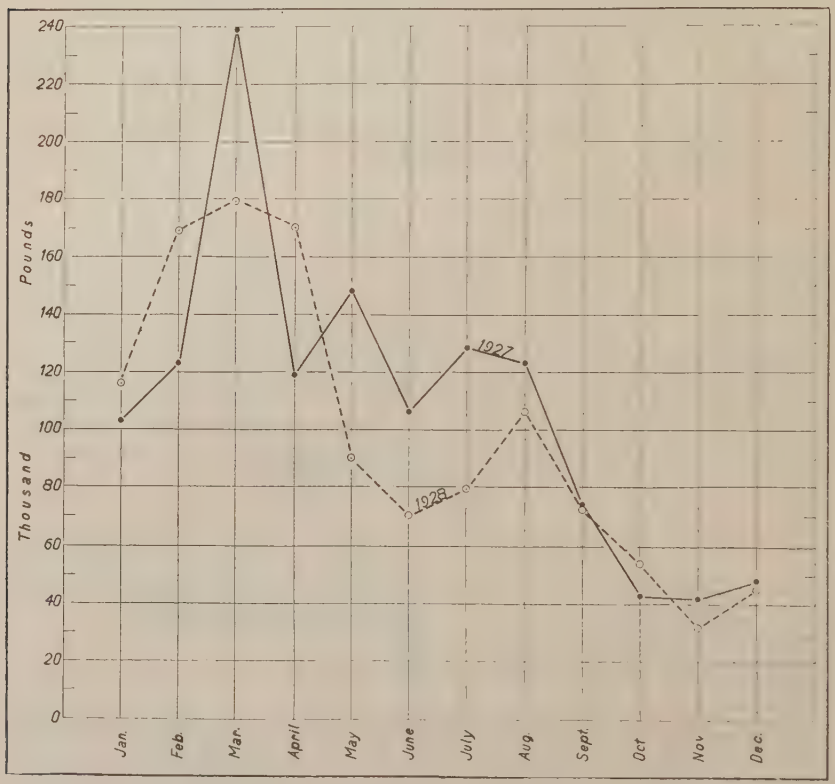

FIG. 40. 1927 and 1928 southern halibut catch by months for the state. Figures include landings from Mexico.

CULTUS COD

By Lionel A. Walford

This fish is not a true cod but belongs to the greenling family (Hexagrammidae) in which also occurs the sea trout, the nearest California relative. The cultus cod is a large fish, attaining a length of 3 or 4

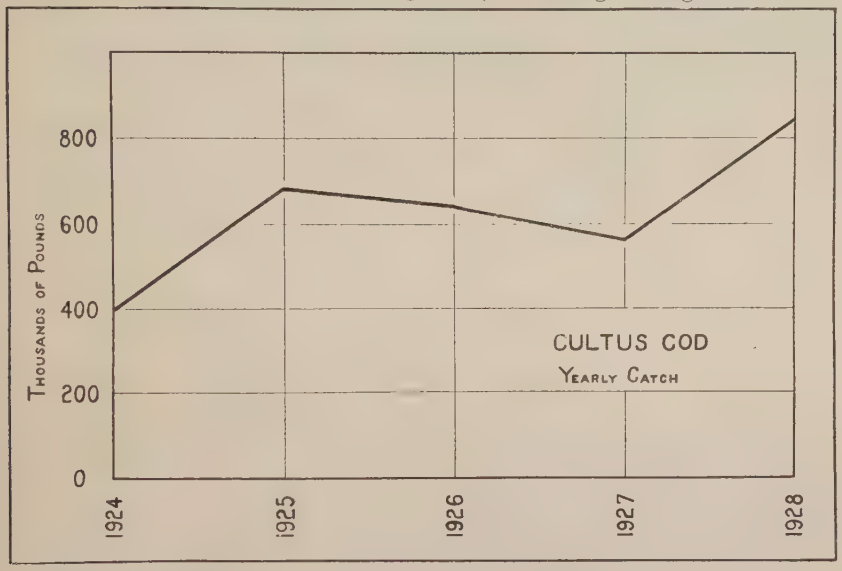

Fig. 41. Annual catch of cultus cod for the five-year period 1924–1928.

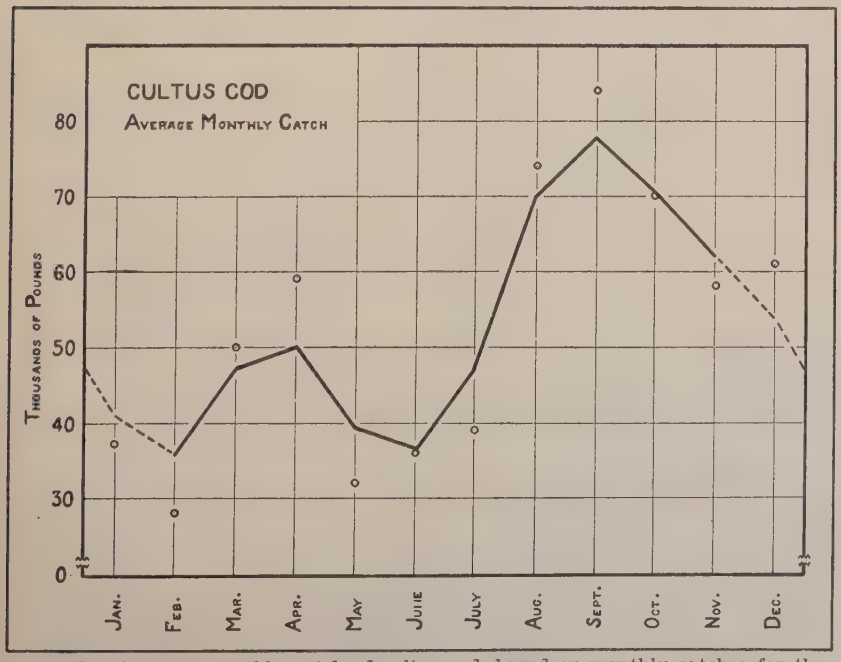

Fig. 42. Average monthly catch of cultus cod, based on monthly catches for the period 1924–1928, inclusive.

feet and a weight of 30 or 40 pounds, and is sold exclusively in the fresh fish markets. In California it is of minor commercial importance, and the trend of its catch over the five years ending 1928 has been rising only slightly. (See figure 41.) A survey of the total monthly catch over these five years has revealed an interesting biseasonal tendency which may be seen in figure 42. This shows the average monthly catch based on the landings of the period 1924 to 1928. There is an all year supply of this fish, with maximum landings from February to May and from August to October.

SWORDFISH

By Annie Gillespie

The more common swordfish on the Pacific coast is *Xiphias gladius*, called broadbill swordfish by the anglers. The only other species under the general class of swordfish is the marlin-spike fish (*Makaira mitsukurii*), which is not a true swordfish. The upper jaw of the broadbill is prolonged into a much longer sword than the marlin-spike fish, and its body is metallic purple in color with no cross bars, while the body of the marlin-spike fish is crossed by narrow light stripes extending down from the back. The broadbill attains a large size, reaching a weight up to 575 pounds, while the marlin runs to about 350 pounds.

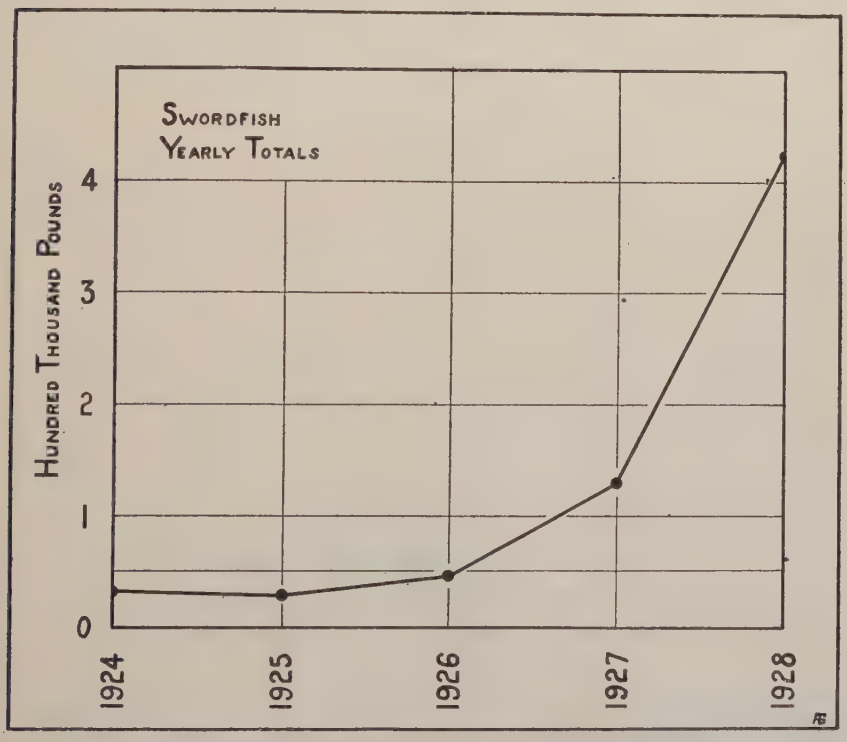

Fig. 43. Yearly catches of swordfish, 1924 to 1928. Includes landings from Los Angeles, Orange and San Diego counties and Mexico.

In past years the swordfish has not held an important place in the commercial catch of California, but since 1925 the catch has been increasing at a rapid rate, and now if present trends continue, it bids fair to hold a place of some importance in the fishing industry. (See figure 43.) There has long been a demand for this delicious fish in the eastern markets, and west coast market men have found it profitable to hold swordfish in storage to ship east after the season is over on the Atlantic coast, although shipments are made during other months as

well. About 90 per cent of the total landings of swordfish are shipped east, mostly to New York, Boston and New Bedford. The new demand for this fish has caused more and more professional fishermen to put their effort to its exploitation.

The swordfish are caught from Santa Cruz Island to Cape Colnett, about 125 miles south of the international boundary line. They are found in the shallow waters around the islands. Swordfish are taken by harpooning, which is done only when the water is smooth and there is no wind.

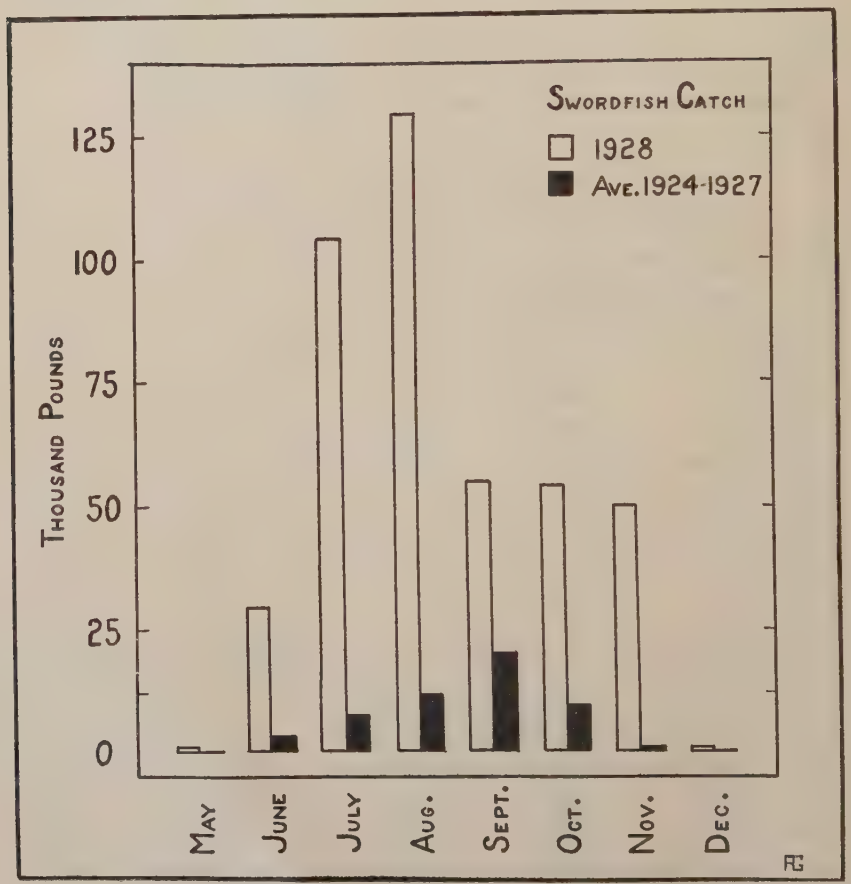

Fig. 44. Monthly swordfish landings, comparison of 1928 catch with average for four-year period, 1924–1927, inclusive. Includes landings from Los Angeles, Orange and San Diego counties and Mexico.

In 1929 the peak of the season came between July and September, while the peak for the average catch of the years 1924–1927 came between August and October. In other words, the largest amounts of swordfish are landed between July and October. (See figure 44.) Whether figure 44 represents the actual season is a matter of uncertainty in view of the fact that the small catches made in the past years may not be a significant picture of the true results of greatest fishing effort.

The largest landings are made in San Diego County, while Los Angeles County is second in importance. (See figure 45.) Small scattered catches are recorded from Mexico, and occasional landings are made in Orange County. This fishery has been more actively exploited off San Diego than off Los Angeles, but if the increased catch for 1928 from Los Angeles is any indication of future growth (see figure 45), the fishing in this region may be expected to equal if not surpass the San Diego landings.

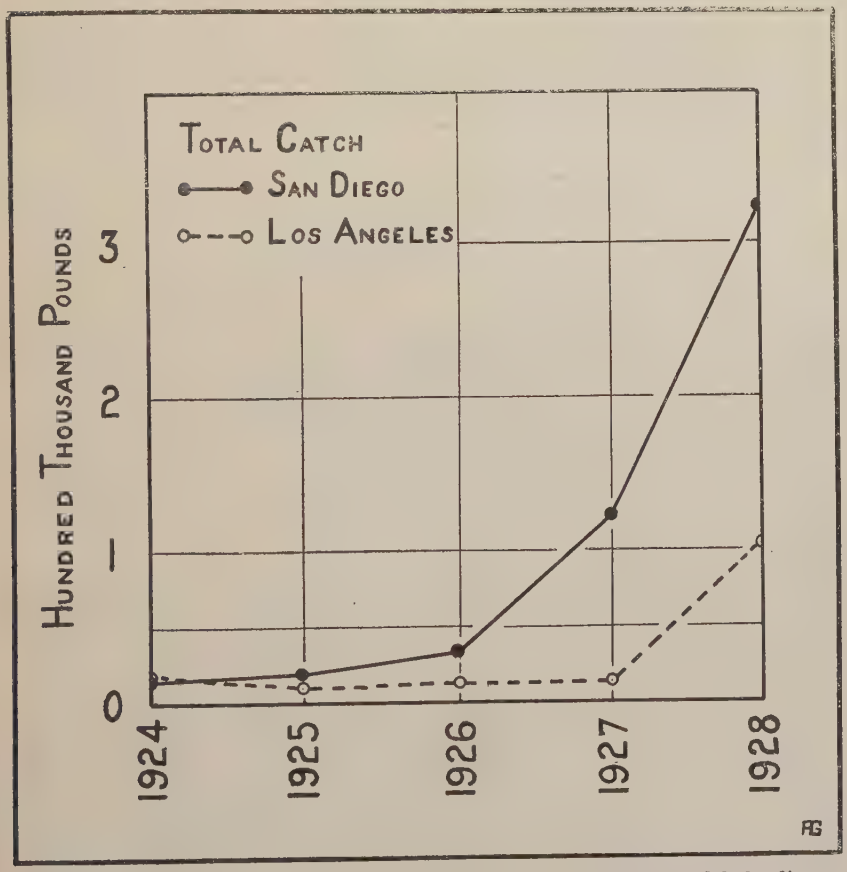

FIG. 45. Comparison of Los Angeles and San Diego yearly swordfish landings.

The price in 1928 ranged from 8½ to 18 cents paid to the fishermen, whereas in New York cafes swordfish steaks sell at $1 a plate. According to the United States Bureau of Census,[1] only 7800 pounds of swordfish were landed on the Pacific coast in 1908, and sold for only 3 cents a pound. The increasing demand will probably raise the price to even greater heights in the next few years, as swordfish is slowly becoming popular on this coast as well as on the Atlantic seaboard.

[1] Special Reports, United States Bureau of Census. Fisheries of the United States, 1908, p. 28, Washington, 1911.

CRABS

By Geraldine Conner

In California waters the Pacific coast edible crab, *Cancer magister,* is taken in commercial quantities from Monterey Bay north to the Oregon line. The catch of this crustacean, calculated in pounds landed per year, forms an important item in the array of fishes for the three districts where crabs are taken in abundance. At San Francisco, where the greatest quantities are landed, crabs take third place in importance among the species brought in to that port for the year 1928, while at Santa Cruz on Monterey Bay, they rank equally as high. For the Del Norte-Humboldt region they fall into fifth place.

A description of *Cancer magister* as well as life history and notes on early fishing methods will be found in two papers by Frank W. Weymouth of Stanford University, published in *California Fish and Game,* as follows: "Contributions to the life history of the Pacific edible crab," Vol. 2, No. 1, 1916; and "The Pacific edible crab and its near relatives," Vol. 6, No. 1, 1920.

In years prior to the period our present statistical records cover, crabs were reported in great abundance within the bays of the state and off the coast wherever the sandy bottoms provided suitable conditions for their living requirements. The shoal waters of the bays are now cleared of marketable sizes except in places where the hoop net fishing method has not been entirely effective, as for instance at Monterey Bay,[1] but at the present time the bulk of the crab supply of the state is taken in deeper water from the sand bars some miles off the coast.

Among the conservation measures enacted by the state legislature, the size limit law is believed to offer the most adequate protection for crabs since it permits the individuals to pass through several spawning seasons before they are legally marketable and thus should assure a continuous supply of breeding stock. At present the size limit is "seven inches in breadth measured straight across the back from point to point," and applies particularly to males, since the females may not be legally taken at any size. The first state legislative protection given crabs was in 1897, when a law was enacted prohibiting the possession and sale of females. The next step was taken in 1903, when a size limit of six inches in breadth was placed upon the males. In 1911 this minimum size limit was increased to seven inches, thus protecting them through at least two breeding seasons and greatly eliminating the possibility of females being taken through inability to distinguish the sexes, since females seldom attain that size.

In order to enforce the size limit law, it was required that all crabs brought ashore or offered for sale be whole and in the shell, so that they could be measured; thus the temptation to offer the meat of undersized crabs for sale was eliminated. Crabs imported from outside the state must fulfill the size limit requirements and may be brought in only under the tagging and inspection restrictions of the state fish and

[1] Chute, George Roger. The crab fishery of Monterey Bay, California. California Fish and Game, Vol. 15, No. 1, pp. 28–33, 1929.

game laws. Crab meat from Japan has always been permitted to enter the state, when the containers are properly marked. This offers no particular problem since the Japanese edible crab, *Paralithodes camtschatica*,[2] which is canned for export, belongs to a different genus, and the meat is readily distinguishable from that of the local *Cancer magister*. However, Alaskan crab meat importations caused a rather difficult situation, since the crabs taken in Alaska are of the same variety as the California commercial crab. Alaska has a supply greater than the local demand, and California, where a taste for this choice crustacean has been developed, offers a good market for crab meat during the slack or closed local season. It would be impracticable, however, to ship the whole crabs from Alaska to California to fulfill the state importation requirements. With the idea of relieving the strain on the local supply, provisions have been made from time to time to permit canned crab meat to come in from Alaska for hotel and restaurant use, provided the large tins in which it was packed were properly marked, and a record sent to the Division of Fish and Game of the amount of the shipments and name of consignee. It has been found that the law prohibiting the sale of crab meat is practically impossible to enforce since to do so would mean that even restaurants and hotels offering crab dishes on their menus would be forced to eliminate these items. It often happens that in catching, cooking or handling crabs, legs are broken off and these cripples are difficult to dispose of in the markets. However, the meat of the crabs themselves and the detached legs will still be edible, and unless they can be picked and the meat sold, the fishermen are deprived of the profits to be derived therefrom. At the 1929 session of the state legislature, the law was amended to permit the sale of crab meat not in the shell.

Added to the size limit protection, there is a closed season on crabs which is timed to cover the shell-shedding period while they are water-soaked and unpalatable. Growth is attained through the molting process, and therefore many individuals have increased to legal size by the end of the closed period and are added to the available market supply at the opening of the next season.

The first closed season was established in 1903 at the time the six-inch minimum size limit went into effect, but the dates of the closed period have been changed several times since then. Scientific observations have proven the present closed season to be the proper one to render the best protection to the crabs of these areas. The closed season at San Francisco and Monterey Bay between July 31 and November 14 of each year has been in effect for over fifteen years. For the Del Norte-Humboldt-Mendocino area (Fish and Game Districts 1½, 6, 7, 8, and 9), the closed period comes one month later but covers an equal amount of time, three and one-half months. The closed season for this region had been the same as that for the balance of the state during the more recent years, but it was changed at the 1929 session of the state legislature since it had been found that the crabs in the north shed their shells a little later in the year than do those inhabiting waters farther to the south.

In the Del Norte-Humboldt region even more stringent restrictive measures have been placed on crabs, and for this reason the commercial

[2] Okuda, Y., and Matsui, H. On the canned crab. Journ. Coll. Agric., Tokyo. Vol. 5, No. 4, pp. 325–337, 1916.

fishery there has not developed to the proportions of which it is probably capable. The present state laws for that locality follow the lines of county ordinances evolved through local sentiment. In the early history of the crab fishery, it was found that the supply of crabs easy

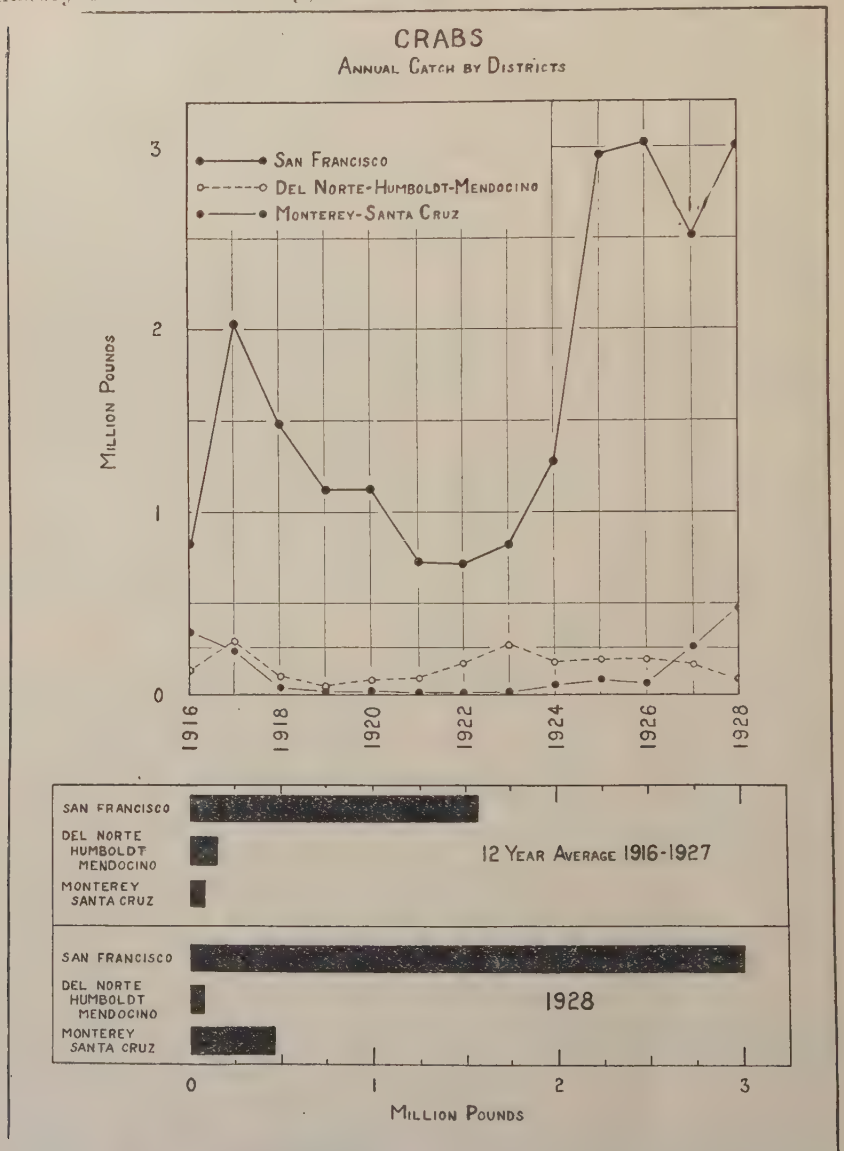

Fig. 46. (a) Yearly crab catch by districts. (b) 1928 crab catch for each district compared with the average yearly crab catch over a twelve-year period, 1916 to 1927, inclusive.

of access to the residents was diminishing and the cause was attributed to Italian fishermen who sailed north from San Francisco to participate in the salmon fishery during the runs in the Del Norte-Humboldt area. A crab preserve was created at the mouth of the Eel River in 1909,

which included both Humboldt and Trinidad bays. Crabs could only be taken from this preserve on Thursdays of each week during the state open season. In 1917 the law was amended to prohibit the shipment of crabs out of the Del Norte-Humboldt district, and also to make it unlawful to hold crabs in live boxes within that area.

These restrictive measures preserved the supply of the district for local use only and have retarded the development of the commercial crab fishery in the northern part of the state. It is doubtful whether this is wise since the occasional resident or tourist fishing for crabs is less apt to respect the size limit law. Thus, the breeding stock of undersized individuals may be drawn upon a few at a time but steadily and with greater detriment to the fishery than when it is exploited by commercial fishermen equipped to fish the less accessible banks, and drawing only upon the stock which has had an opportunity to pass through several spawning seasons, leaving progeny to meet the future demands upon the fishery.

The crab catch is reported to the state in dozens, but in order to make the figures conform with those for other species of fish, mollusks and crustaceans, the dozens have been reduced to pounds by computing each dozen at 24 pounds. For the 1927–1928 season, the wholesale price ranged from $2.30 to $2.55 per dozen at San Francisco, where the catch of that district is delivered to the Crab Fishermen's Protective Union, which organization acts in the capacity of the wholesaler for its members. About 225 union members participated in the crab fishery out of San Francisco during 1928.

The fishery in the vicinity of San Francisco contributed 84 per cent of the 1928 total crab catch for the state and seems to be holding up well under the seven-inch size limit law and the present closed season. The graph of yearly catches (see figure 46) shows the rise from the 1922 low point of 700,000 pounds to the peak of over 3,000,000 pounds in 1926. Although the 1927 catch dropped below the peak year, it is still very high in comparison with the earlier years recorded, and the 1928 catch came within a few thousand pounds of the 1926 high point.

In 1928, the Monterey Bay crabs, most of which are landed at Santa Cruz, made up about 13 per cent of the total crab catch for the state. It will be noted that the crab landings for this area, though of minor importance when compared with the San Francisco catch, have in the last two years made a rapid rise which has placed the district in second place in amount landed. From a 350,000 pound point in 1916, Monterey Bay declined until in 1922 less than 2500 pounds were recorded. The rise from that year to 1926 was gradual with a jump to 260,000 pounds in 1927, and to almost double that amount or 475,000 pounds in 1928, when the peak was attained. This recent increase is due to a change in fishing method, which is described in the article previously referred to, "The crab fishery of Monterey Bay, California."

Less than 3 per cent of the state's 1928 commercial crab catch was reported from the extreme northern coast of the state off Del Norte, Humboldt and Mendocino counties. The peak for this district was in 1917 when 280,000 pounds were recorded. At this time the nonshipment clause was added to the state law for this region, and the commercial catch records for the years immediately following show the effect of this restriction, while in 1919 the low point of 45,000 pounds

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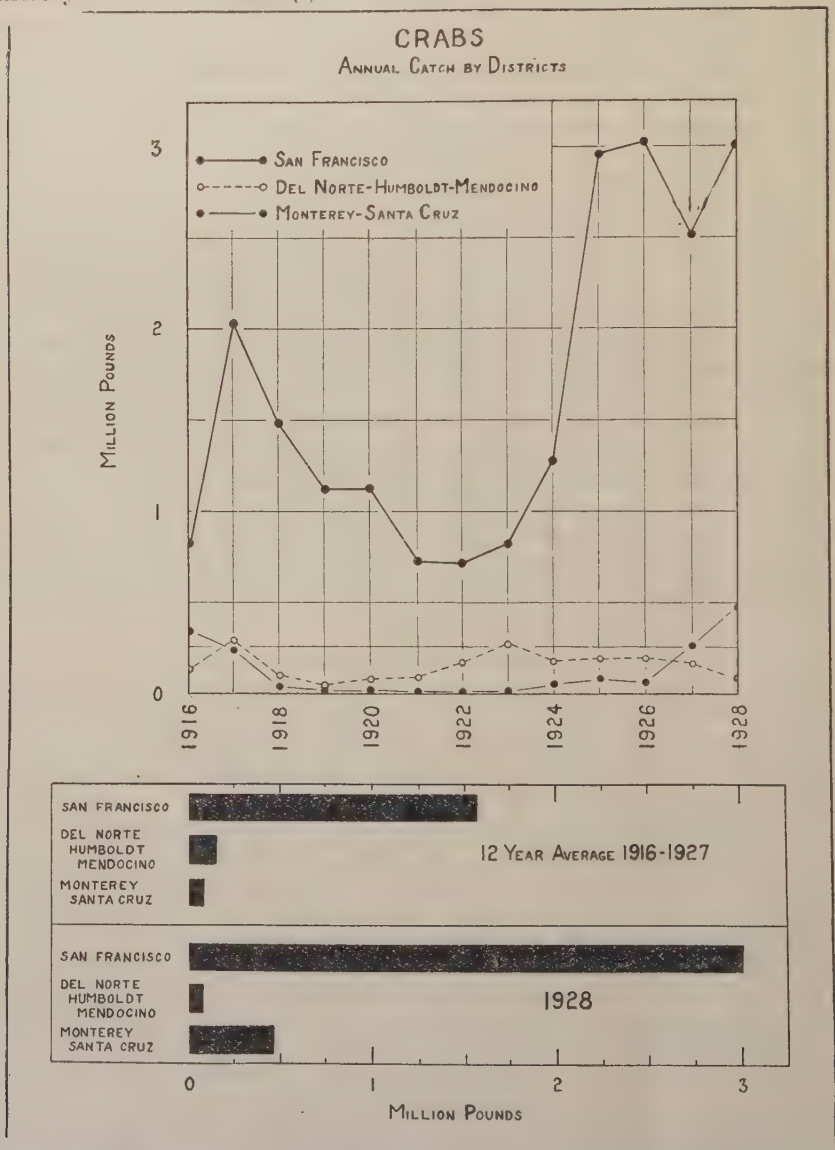

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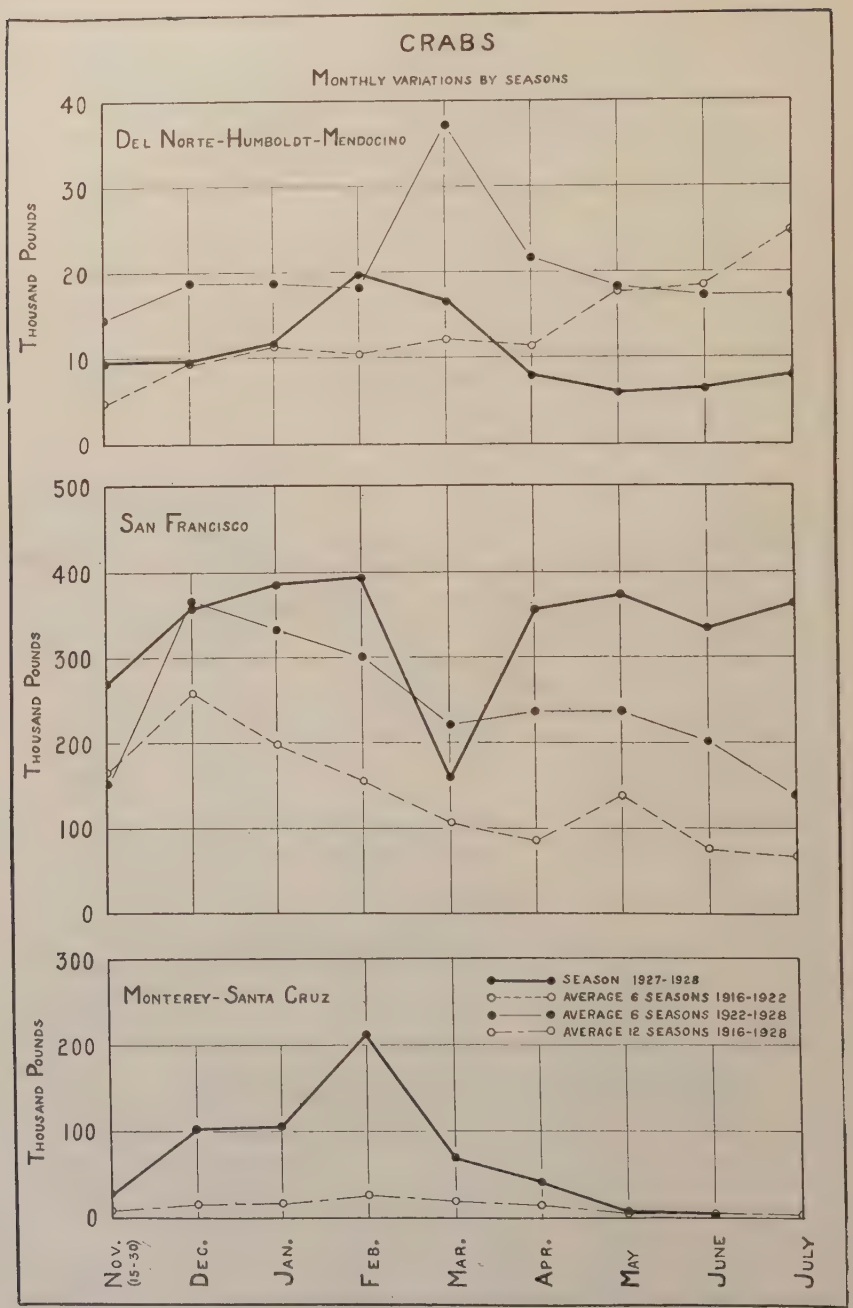

FIG. 47. Crab catch by seasons. (Season opens November 15, therefore in all cases November figures represent catch for only one-half of the month.) (a) The 1927–1928 season for Del Norte, Humboldt and Mendocino counties compared with the average season over two six-year periods, 1916 to 1922 and 1922 to 1928, inclusive. (b) Similar comparison for the San Francisco crab seasons. (c) The 1927–1928 season for Monterey and Santa Cruz counties as compared with the average season over a twelve-year period, 1916 to 1928, inclusive.

was reached. The year 1923 brought the catch back up to 260,000 pounds, but from that time on it has declined with only 86,000 pounds reported for 1928.

Since there is a closed period which runs from July 31 to November 14, inclusive, of each year, in considering the crab seasons we have included November and December of one year with the first seven months, January to July, inclusive, of the year immediately following. In figure 47, the season of November 15, 1927, to July 31, 1928, has been compared with seasons from November, 1916, through July, 1928. It must be borne in mind that the point given for November represents only half of the month, since the first half of the month is in the closed period.

For the northern part of the state, Del Norte, Humboldt and Mendocino counties, the peak of the 1927–1928 season came in February with a good catch in March. This is a little earlier than the high point for the average of the six seasons from November, 1921, through July, 1928, which fell in March. The average of six early seasons from November, 1916, through July, 1922, shows the low point in November with a steady rise until the peak is attained in July, the last month of the open season. This would seem to indicate that the crabs are on the banks and available all through the open season, and the high point merely marks the month when the greatest effort is made to take them or the weather best suits the fishing operations.

At San Francisco the early six-season average—November, 1916, through July, 1922—and the later six-season average—November, 1922, through July, 1928—run parallel to one another, the later period having the same trend, but on a plane of about 100,000 pounds a month higher. The peak of the season comes at the beginning when there are the greatest number of crabs of marketable size available and when the demand probably causes greater effort.

The 1927–1928 season had a good beginning with a steady rise until March, when it fell to a very low point in comparison with the catches made during the other months of the season. There is always a slight drop in March, but it never before has been as noticeable as in 1928.

There was no marked differences in the six-year averages for the Monterey Bay seasons, and therefore an average of the twelve-year seasons from November, 1916, through July, 1928, has been plotted and compared with the 1927–1928 season. The decided increase in the recent catch is at once apparent, but it will be noted that the high point of the season has fallen consistently in February throughout the years.

SHRIMPS

By G. H. Clark

The shrimp fishery was started in San Francisco Bay in 1869 by A. Paladini.[1] At that time there were eight boats operating out of San Francisco manned by Italian fishermen who used small meshed seines to capture the shrimps.

In 1871 the Chinese began to fish shrimps with their destructive Chinese shrimp nets, and these new fishermen soon drove the Italians out of business by underselling them. The Chinese bag nets destroyed large numbers of young fish and in time caused the legislature to put seasons on shrimp fishing and to prohibit the drying of shrimps. At the 1910–1911 session of the legislature the use of Chinese shrimp nets was prohibited entirely. However, by this time it was unprofitable to fish for shrimps with seines or drag nets.

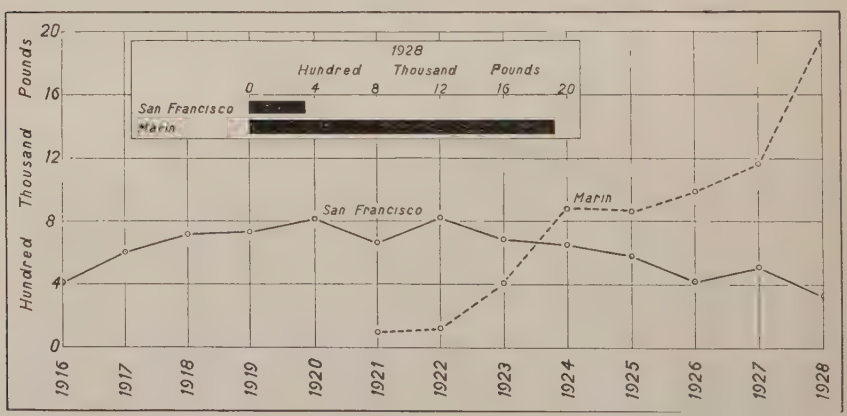

Fig. 48. Catch of shrimps by years from 1916 to 1928, San Francisco compared with Marin County. Bar chart showing 1928 shrimp catch by districts.

In 1915 the restriction on Chinese nets was raised in South San Francisco Bay (District 13), and fishing has been carried on in this region up to the present time (1929). In 1921 the use of shrimp trawls was allowed in South San Francisco Bay and in San Pablo Bay (District 12). However, they have only been used in San Pablo Bay. An enterprising fisherman has set up his camp on San Quentin Point and uses shrimp trawls. He has been so successful that the catches landed in Marin County have in the last few years surpassed those of San Francisco. (See figure 48.) Figure 48 also shows the catch of San Francisco and Marin counties from 1916 to 1928. The San Francisco catch is decreasing while the Marin catch is steadily mounting, as is evident by the landing of nearly 2,000,000 pounds in 1928, while the San Francisco landings amounted to only little more than 300,000 pounds. (See figure 48.)

[1] Scofield, N. B. Shrimp fisheries of California. California Fish and Game, Vol. 5, No. 1, pp. 1–12, 1919.

SQUID

By W. L. Scofield

Down among the cuttlefish, mussels and oysters, at the very foot of the list of the fishery products of California, will be found the squid, an inhabitant of the ocean that is classed as a mollusk, but it is more active than some fishes. This lively fish-like mollusk is seldom mentioned, and its importance in the California catch is overlooked, but it usually ranks among the first twelve species of the state in amounts landed, and if we exclude the species used for canning, the squid occupies about sixth place. This large tonnage is accounted for by the fact that the Chinese dry the squid in the sun and ship the huge bales of cured meat back to their homeland where it is more appreciated as food than here, where we frequently fail to recognize good food when we see it. It is not the fault of the squid that the Chinese method of drying is far from cleanly.

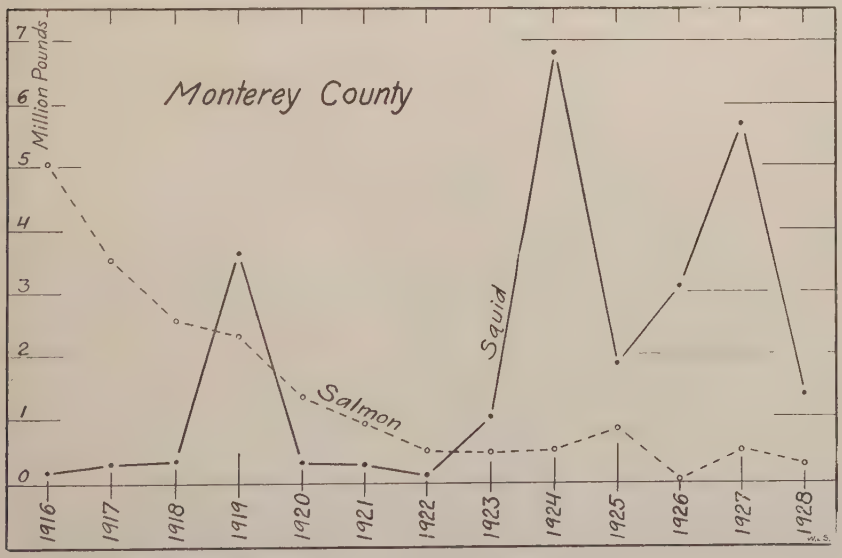

Fig. 49. The annual catches of squid in Monterey County contrasted with the landings of salmon in that county. The squid catch, although fluctuating, has exceeded the declining salmon catch.

Squid are caught in small quantities at various places along the coast south of the Golden Gate, but the big catches are landed at the town of Monterey, on Monterey Bay. Even here the importance of the squid catch is underestimated. The fish dealers of Monterey for many years were occupied with handling salmon which was, pound for pound, the most valuable species of that port. After the salmon supply failed, their attention was attracted by the abalone, another mollusk, which sells at a much higher price per pound than the squid, but if we judge solely by the quantity landed, the squid outranks either the salmon or abalone at Monterey.

In the last thirteen years (1916 to 1928, inclusive) the salmon catch of Monterey County has totaled a little less than 19,000,000 pounds,

whereas the squid catch during the same thirteen years has amounted to more than 25,000,000 pounds. The abalone catches of this county have totaled 18,000,000 pounds for the same period of years. The annual catches of both squid and salmon at Monterey are presented in figure 49 for the sake of contrast. The steady decline of the salmon catch from 1916 to 1923 occurred in spite of the increased fishing effort during those years. The violent fluctuations in the squid catch are said by some fishermen to be the result of the presence of great quantities of squid in the bay some years and their failure to appear at other times. This no doubt is partially true, but as squid are dried for export it is probable that economic conditions also play a very important part in determining the size of the catch. For example, during one season when squid were reported as very abundant in the bay, two rival Chinese firms were so involved in a law suit that neither company was able to dry that year and consequently the catch was very small.

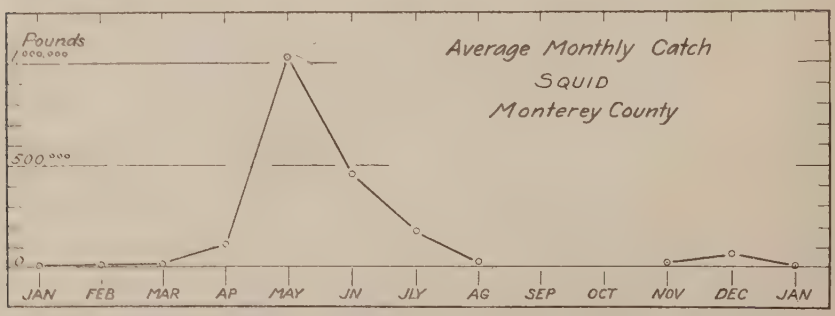

FIG. 50. Shows the average monthly catch of squid in Monterey County. The thirteen-year period 1916–1928 was used in obtaining monthly averages.

In figure 50 the average catch of squid in Monterey County has been plotted for each month of the year. These averages were determined from the thirteen-year period 1916–1928. From this graph it appears that May and June are the chief squid months. The period from April through July is said to be the time when squid appear in Monterey Bay, but this is also the period when the sardine canneries are not operating and the squid are caught by the sardine fishing crews in their lampara nets. No such crew would bother with squid while the canneries are receiving sardines, so possibly if something should happen causing the canneries to close entirely, it might be found that squid could be caught during other months of the year.

CALIFORNIA SPINY LOBSTER

By D. H. Fry, Jr.

The spiny lobster, salt water crayfish, or langouste, is found in tropical and semitropical waters all over the world. The California species (*Panulirus interruptus*) is found from Point Conception south into Central America. It has been reported in the Gulf of Tehuantepec and may continue even farther south. Spiny lobsters (family Palinuridae) are in no way related to the true lobsters (family Homaridae) of the North Atlantic.

The California spiny lobster occasionally reaches a weight of about 20 pounds, though individuals of such large size are seldom seen. The average length of lobsters taken varies greatly in different localities. At San Clemente Island and La Jolla, it is under 9 inches, while at San Nicholas Island nearly all individuals are said to be over 14 inches,

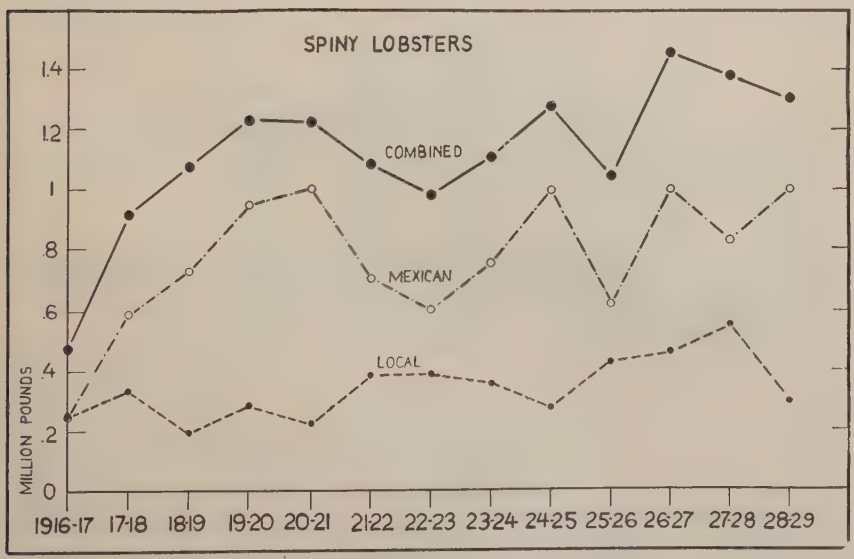

Fig. 51. Seasonal spiny lobster landings.

and most of them over 16. (A 16-inch lobster will weigh about $3\frac{1}{2}$ pounds.) The *legal* size is from $10\frac{1}{2}$ to 16 inches. The smaller lobsters are protected to give them a chance to spawn at least once before capture. The upper limit is to protect the largest individuals, which are presumed to be the heaviest spawners. The bootlegging of undersized lobsters is constantly being done, though the oversized ones are fairly safe, as the restaurants have no use for them. In fact the demand for large lobsters is so much less that those over 14 inches bring a lower price.

The lobster landings in California (see figure 51) are made up of local lobsters and those imported from Mexico. The local catch, as can be seen, shows an upward trend. This rise is due entirely to the

increased effort brought about by rising prices. The sharp drop in the 1928–1929 season may be a temporary fluctuation and may indicate a turning point in the fishery.

The Mexican catch, which now dominates the fishery, was only about the same size as that of California in 1916. The rapid growth for the next few years was due to the opening up of new grounds. By the end of the 1920–1921 season, the small gasoline boats which were being used to transport the catches from Lower California had gone as far south as was practical. Virgin lobster grounds are several times as productive as those which have been fished even a few years, and consequently, when no new grounds were being opened, the fishery fell off rapidly. The next rise, starting after the 1922–1923 season, was due to the introduction of Diesel powered transports. Since then there has been a race to improve methods of transportation rapidly enough to extend the fishery as fast as the old grounds are depleted. The drop in the 1927–1928 season was due to the accidental sinking of the two largest lobster transports. As there were only five transports, it is a wonder that the effect was so slight.

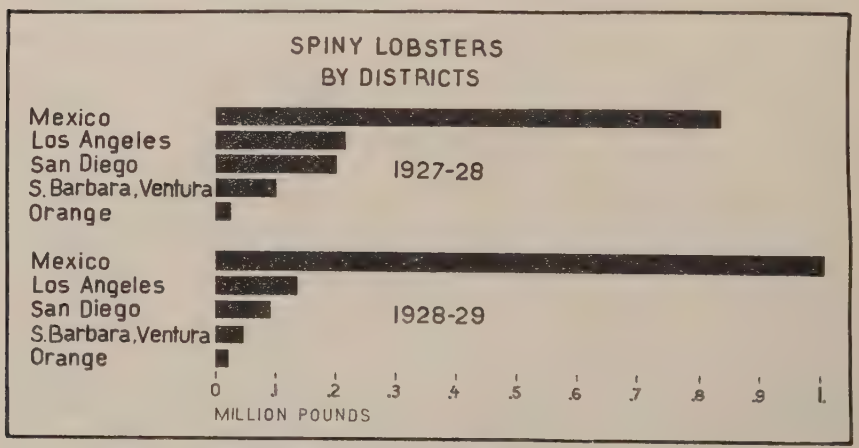

Fig. 52. Spiny lobster landings by districts during 1927–1928 and 1928–1929 seasons.

The Mexican transportation problem is to get the lobsters to San Diego while they are still alive, since they spoil almost immediately after death. It is necessary to "drink" the lobsters at least once every 24 hours. The drinking process consists of lowering the crates of lobsters overboard for several hours. Of course, this slows up transportation tremendously. Methods are being devised to eliminate the drinking process by the pumping of fresh sea water over the lobsters.

The relative importance of the various districts during the past two seasons can be seen in figure 52. The explanation is, in brief, as follows:

Mexico—The fishing area on the Lower California coast is far larger than that of the entire state of California and, in addition, has been much less heavily fished.

Los Angeles—The lobsters landed at San Pedro are mostly caught on the shores of the Channel Islands off Ventura and Santa Barbara. The

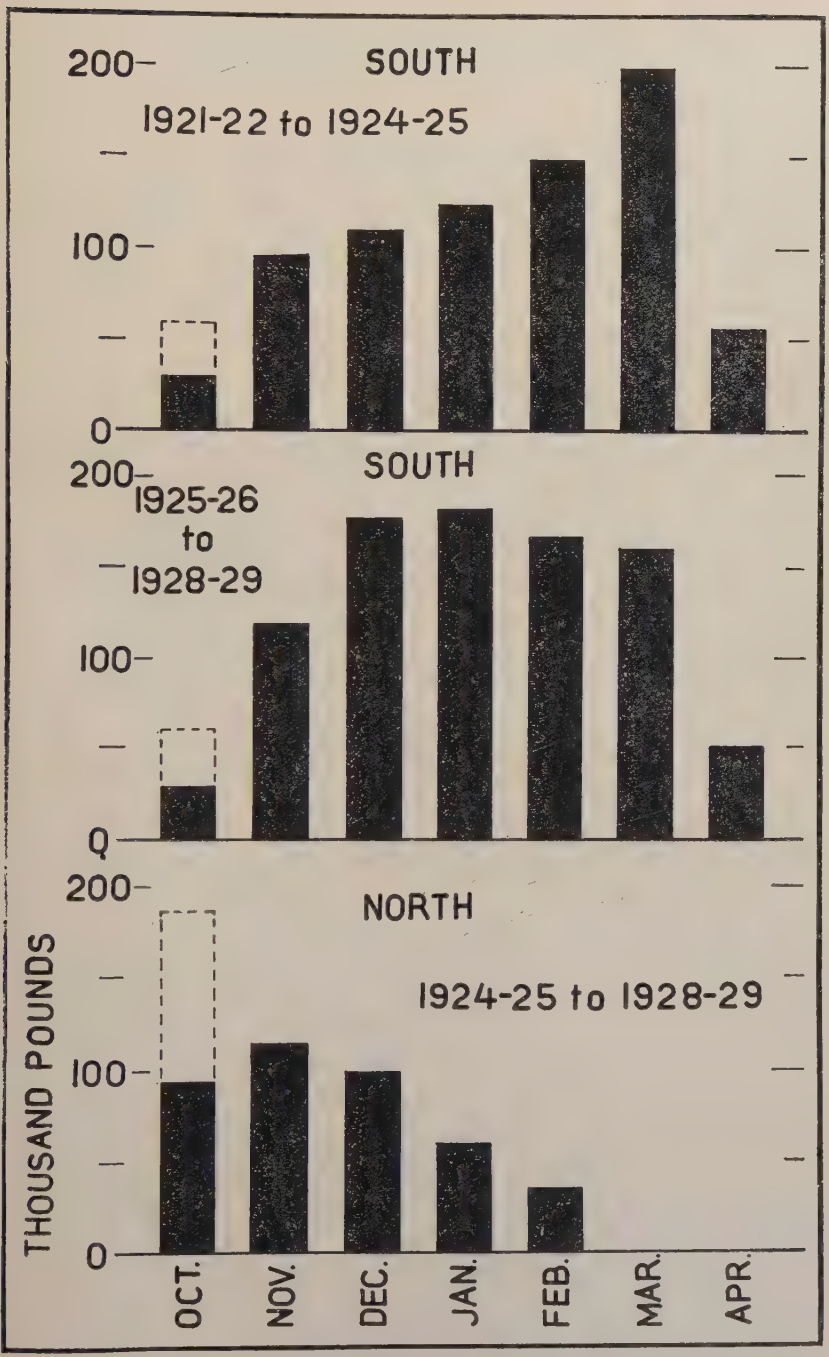

FIG. 53. Spiny lobster seasons north and south of the international boundary line. (Season opens October 15; skeleton represents full month.)

fishing area of Los Angeles County includes not only its own grounds, but those of Ventura and Santa Barbara counties as well.

San Diego—There are good grounds off San Diego County, in addition to which many lobsters which are landed at San Diego are caught outside the county.

Santa Barbara, Ventura and Orange Counties—The lobsters landed in these counties are intended for local consumption.

The trade at San Diego is principally in cooked lobsters. This is because those brought from Mexico are in such a weakened condition that they must be cooked immediately. At Los Angeles the trade is almost exclusively in live lobsters and prices are several cents higher.

The season at which spiny lobsters may be legally taken in California is from the fifteenth of October to the last of February. The Mexican season opens at the same time and closes a month or more later. The closing date is left to the discretion of the local officials and is quite irregular. The reason for a closed season is to enable the lobsters to spawn in peace and to protect them throughout the summer, when they come into such shallow waters as to make catching them altogether too easy.

The most productive part of the fishing season in California is the first two weeks after the season opens, *i. e.*, the last half of October. November and December hold up fairly well, but after the first of the year, the catch declines quite rapidly until the end of the season. The reasons for this are the depletion of the most easily accessible grounds and an offshore migration which takes place as winter advances. The early season peak is also accentuated by many men being lured into the business by the high prices offered and the small investment required. It seems to be easy money, but after they discover that the work is anything but easy and that there isn't much money in it, most of them give up in disgust.

Along the Lower California coast, conditions are decidedly different. (See figure 53.) In earlier years (prior to 1925–1926), the season got off to a gradual start and rose steadily to the peak in March. April showed a far smaller catch, but this was primarily due to the fact that the season usually closed some time in that month. The peak in March was due to the demand for lobsters to be frozen and kept for use throughout the closed season.[1] In the last four years conditions have not been quite the same. The season started in gradually, as before, but the peak came in December, after which there was a gradual dropping off until April, which was usually not a full fishing month, as was mentioned before. This change in the season suggests the result of depletion, since the demand in March is undoubtedly as great as it ever was, and the fishermen are unable to keep up the supply.

Just what is going to happen to the spiny lobster supply? At present the catch is being kept up by continually extending the fishing grounds, but unless refrigeration ships or other radically different methods of handling are devised the limit of the expansion can not be far off. Already the carriers are bringing lobsters from 450 miles south of the international boundary line.

[1] A large part of the Mexican catch is preserved in cold storage. California lobsters, on the other hand, must be disposed of during the open season. The Mexican lobsters are marked under the supervision of a deputy of the Division of Fish and Game of California, that there may be no question about where they were caught, when they are offered for sale during the California closed season.

THE FIVE TUNAS AND MEXICO

By Geraldine Conner

It would be difficult to consider the catch, the seasons or, in fact, anything having to do with the landings of tuna in California ports without bringing Mexico into the foreground of the discussion. From the waters off the coast of Mexico have come over 65 per cent of the tuna landed in the United States and packed in the canneries at San Pedro and San Diego, California, during the year 1928. With each passing year this fishing area south of the United States boundary has become of greater importance and is extended to cover more territory.

In the early history of the tuna canning industry in California, 1916 and 1917, the supply was caught entirely in local waters. Albacore were abundant close at hand and about the only species used for canning at that time. The boats engaged in tuna fishing were small, averaging about 30 feet in length, and the fishing area extended for approximately 300 miles along the coast of southern California, from Point Conception to the Mexican line, within a day's run from the canneries at San Pedro and San Diego. In 1917, the peak year for albacore, about 34,000,000 pounds were taken in local waters, but in 1918 only one-fourth of that amount was landed. Because of the failure of the albacore that year other species of tuna attracted the attention of the canners. Bluefin and bonito, which were also taken locally, were sought by the fishermen. Skipjack and yellowfin were the last of the tunas to be used in any quantity for canning. They range farther to the south in Mexican territorial waters and in the high seas off the coast of Lower California, Mexico.

With the decline of the local fishery and the increased demand for tuna, the necessity arose for the building of larger boats capable of making long cruises in order to exploit the skipjack and yellowfin fishery off the coast of the arid peninsula of Lower California. Because of the scarcity of fresh water and inadequate depots to replenish the fishing fleet with supplies of fuel oil and foodstuffs, greater carrying capacity was necessary and refrigerated storage space for the fish was essential. The vicinity of Turtle Bay, which offered safe anchorage for the boats half way down the Lower California peninsula, and the waters about Cape San Lucas at the tip of the peninsula, 1000 miles south of the United States boundary, became the main sources of tuna supply for the canneries in California. From Cape San Lucas the larger boats gradually worked out into the Pacific and occasional catches have been made in the vicinity of Socorro and Clarion islands and on the Allaire Banks, 500 miles offshore.

The accompanying map (figure 54) shows the extent of the present tuna fishing grounds. When we consider that the chief tuna fishing area is confined to the region south of Point Conception, it is apparent that only a small portion lies off the coast of the United States. This map also serves to show that the canneries at San Pedro and San Diego, California, the home ports of the tuna fleet, are really at the northern extremity of the tuna fishing grounds upon which they are dependent for their supply.

The tuna fishery continues to develop farther toward the south. In April of 1929, there were delivered 28 tons of yellowfin and skipjack to the canneries at San Pedro which had been caught in the vicinity of

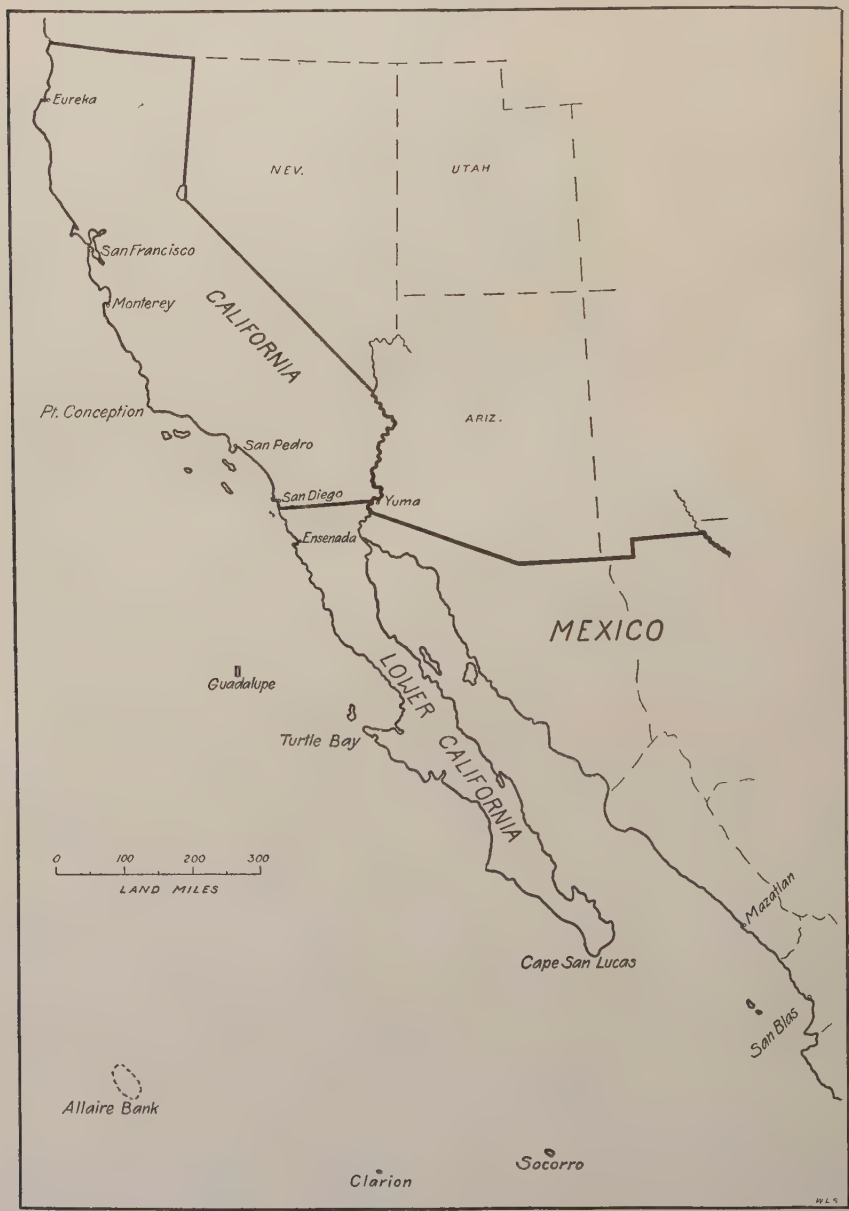

FIG. 54. Fishing area upon which California is now dependent.

Cocos Island, off the coast of Costa Rica, Central America, 2500 miles south of the United States' southern boundary on the Pacific coast. These fish were delivered by the 150-foot fishing vessel *Hermosa*, which is equipped with a Diesel engine and refrigerated storage space.

So we find that in a fourteen-year period from 1916 to 1929, the grounds fished by the California tuna fleet have increased from a 300-mile United States coast area to a 3000-mile Pacific coast stretch of waters, extending within but a short distance of the equator and out upon the high seas for hundreds of miles. The small boats of the fishing fleet which formerly were able to make capacity catches within a day's run of the canneries, have been replaced by vessels capable of making cruises of three weeks duration.

The Mexican tuna fishery being adjacent to and actually an extension of the fishery off our own coast, its welfare and productivity are of vital importance to us. The fact that it supplies the bulk of the tuna packed in the canneries in the United States increases our interest and responsibility in it.

The tuna fishery has been developed entirely by United States capital and enterprise. With the exception of a very small amount delivered in Mexico, the tuna are brought to California ports for packing and a great industry has been built up in the United States which is dependent upon the supply available off the coast of Mexico. For the past twelve years California has collected data covering the daily boat landings of both local and Mexican caught tuna for the purpose of analyzing the catches. Plans have been made for research work to determine the needs of the fishery, but have not as yet progressed to a point where any definite conclusions may be drawn. In the meantime the local supply has become scarce and with the extension of the fishing area, Mexico as well as the United States should be vitally concerned with the conservation of the tunas since the largest portion of the fishing grounds lies in the high seas off the Mexican coast. Mexico has levied a heavy export duty on fish which is taken or transported near enough to her shores to bring it under her jurisdiction, but has contributed little toward the scientific care of the fishery. With the 1929 delivery from the coast of Costa Rica, jurisdiction over the fishery and the burden of its care is extended to include a third government, and the possibility of future international complications make it quite obvious that some concerted effort should be made to adopt and further a uniform program, which will provide the proper scientific protection for the tunas and at the same time protect the interests of the nations involved. This will naturally work to the good of the industry as well as to the preservation of the fish.

From far Japan came 5 per cent of the tuna landed in California ports in 1928, and Hawaii contributed less than 1 per cent. In comparison with the total tuna landings, these shipments from distant places appear to be of little importance but the fact that they were composed entirely of albacore of the species *Germo germo*, the same as is taken off our California coast, and that they were twelve times greater in amount than the local catch of what was formerly our most important species of tuna add especially to their significance. This fish was packed in ice and delivered to the California canneries by the trans-Pacific passenger and freight liners. Although it is of the same species as our native fish, we are not as yet directly concerned with the fishery from which this albacore comes, but we are interested in this new source of supply. Naturally, it requires entirely different consideration from the fish taken by California boats off the coast of Mexico, which is separated from us merely by an imaginary line.

In a previous publication[1] the catch of the more important species taken from Point Conception in California south to the Mexican line was compared by years with the amounts of these same species taken off the coast of Mexico and landed in California ports. The tunas naturally played an important role in the discussion. We will now supplement this work by presenting in graphic form the trend of the total California landings of the five tunas including the 1928 records; the 1928 landings of Mexican fish in California ports in the order of their importance; the relative importance of the Mexican, Japanese and Hawaiian contributions to California's total tuna landings; and the seasonal variations of each variety of tuna as indicated by the figures covering monthly catches off the coasts of California and Mexico.

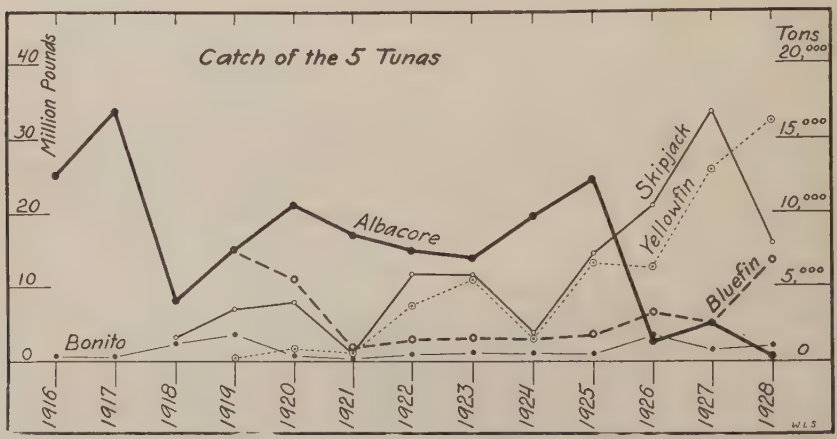

FIG. 55. The annual catches of the five species of tuna landed in California, including Mexican fish but exclusive of the albacore shipped in from Japan and Hawaii.

In a comparison of the total yearly landings in California of the five tunas covering a period from 1916 to 1928, inclusive (see figure 55), we find that in 1928 yellowfin tuna has taken first place in importance among the tunas for the first time in the history of tuna fishing. The upward climb from 1924 continued until in 1928 yellowfin attained a peak of 32,000,000 pounds. Less than one-fourth of 1 per cent of this yellowfin was taken off the coast of California, the balance came from waters off the coast of Mexico.

Skipjack, which ranked first for two successive years, dropped from its 1927 peak of 34,000,000 pounds to less than one-half that amount or 16,000,000 pounds in 1928, and into second place in importance. This drop in the skipjack catch is reflected in the decline of the Mexican total catch figures since the bulk of the skipjack has been taken in Mexican waters in recent years.

Bluefin tuna has run along at the discouragingly low point of a few million pounds a year since 1921. In 1928 it had a marked rise to 14,000,000 pounds, which is the greatest amount taken since its peak year

[1] Conner, Geraldine. Comparison of the catches north and south of the international boundary. Division of Fish and Game of California, Fish Bull. No. 15, pp. 50–62, 1929.

of 1919, when 15,000,000 pounds were landed. This was most encouraging since bluefin is caught entirely in the waters off the coast of California.

Bonito, which has never been especially important in comparison with the other tunas, took fourth place in 1928 with a total of 2,000,000 pounds, which was about an average catch for this species.

The local albacore catch of only 315,000 pounds made 1928 the poorest year we have yet recorded for this most desirable tuna. In comparison with the 34,000,000 pounds taken in 1917 when the albacore fishery was at its height, the 1928 landings were but one-tenth of 1 per cent. The Japanese and Hawaiian caught imports amounting to 4,000,000 pounds have not been included with the local albacore figures since, unlike the Mexican fish, they come from entirely different fishing grounds.

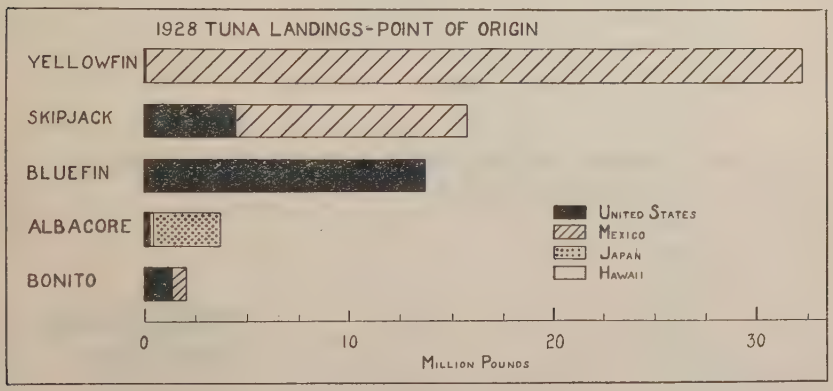

FIG. 56. Total landings of the five tunas in California ports showing point of origin of the catches.

In considering the point of origin of the catches of tuna landed in California ports, we are concerned chiefly with the fish taken in local waters and off the west coast of Mexico, since they are catches from one and the same fishery despite the legal barrier which separates the two adjacent countries and waters off their coasts.

In the array of tunas (see figure 56), we have shown the species in order of their importance for 1928 landings in California ports. The comparative amounts of each species originating from the waters off the coasts of the United States, Mexico, Japan and Hawaii have also been shown. The table below gives in figures the amount contributed by each country to the 1928 total tuna landings in California:

Mexico	44,491,000 pounds
United States	19,832,000 pounds
Japan	3,725,000 pounds
Hawaii	57,500 pounds

In 1928, landings of Mexican caught fish in California ports, as shown in figure 57, were about 12,000,000 pounds less than the landings for the previous year. This was due in the main to the shortage in the Mexican skipjack catch for 1928. Yellowfin tuna replaced skipjack in first rank among the fishes taken off the west coast of Lower California by a 21,000,000-pound margin. The yellowfin from Mexico totaled

32,000,000 pounds, while the skipjack came next with a total of 11,500,000 pounds, and all other fishes, including lobsters, amounted to 6,000,000 pounds.

From the Gulf of California, approximately 2,000,000 pounds of fish were brought overland in trucks to the markets in southern California. Most of this was totuava. Although the fishery in the Gulf has nothing in common with the tuna fishery off the west coast of Mexico, totuava has been placed in the array of fishes from Mexico to show its importance in comparison with other species caught south of the international line.

Tuna Seasons.

In discussing the seasons in which each variety of tuna is taken, we will consider the species in order of their importance in the 1928 catch. The fishery off the west coasts of the United States and Mexico has been separated into two units in some instances since the height of the fishing season for yellowfin, skipjack and bonito in the northern portion of the fishing area varies slightly from the southern season. Since our

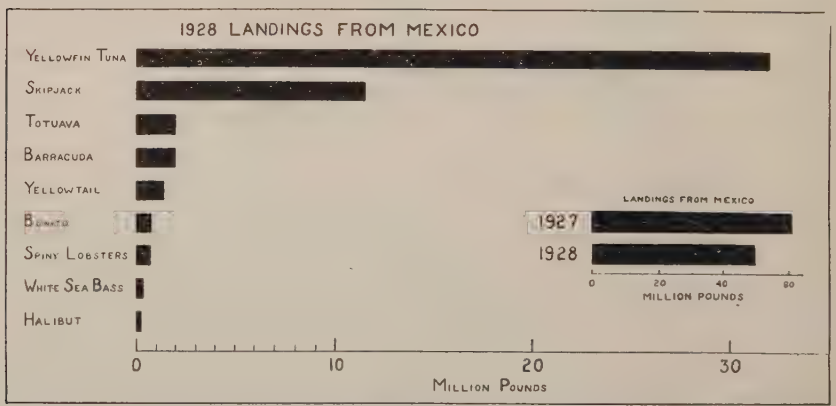

FIG. 57. (a) 1928 landings of Mexican fish in California ports. Totuava from Gulf of California, all other species from west coast of Mexico. (b) Comparison of 1927 with 1928 total landings of Mexican fish in California ports.

records separate the Mexican from the locally caught fish, for convenience we have used an extension of the international line as the point of separation.

A glance at figure 58 shows us that the yellowfin tuna season off the Pacific coast of the United States is at its height between the months of July and November, while farther south off the Mexican coast the season runs from August of one year to June of the year following with two distinct periods of the year when greater amounts of fish are taken. These high months are from March to June and from August to December. In May no fish are reported off the California coast while July is the poorest month for Mexican yellowfin.

The monthly catches of yellowfin tuna for 1928 have been compared with the average monthly catches for the eight-year period from 1920 to 1927, inclusive, the catch off the coast of California and that off the Mexican coast being treated separately. We find that while the early California catches as reflected in the eight-year average were quite

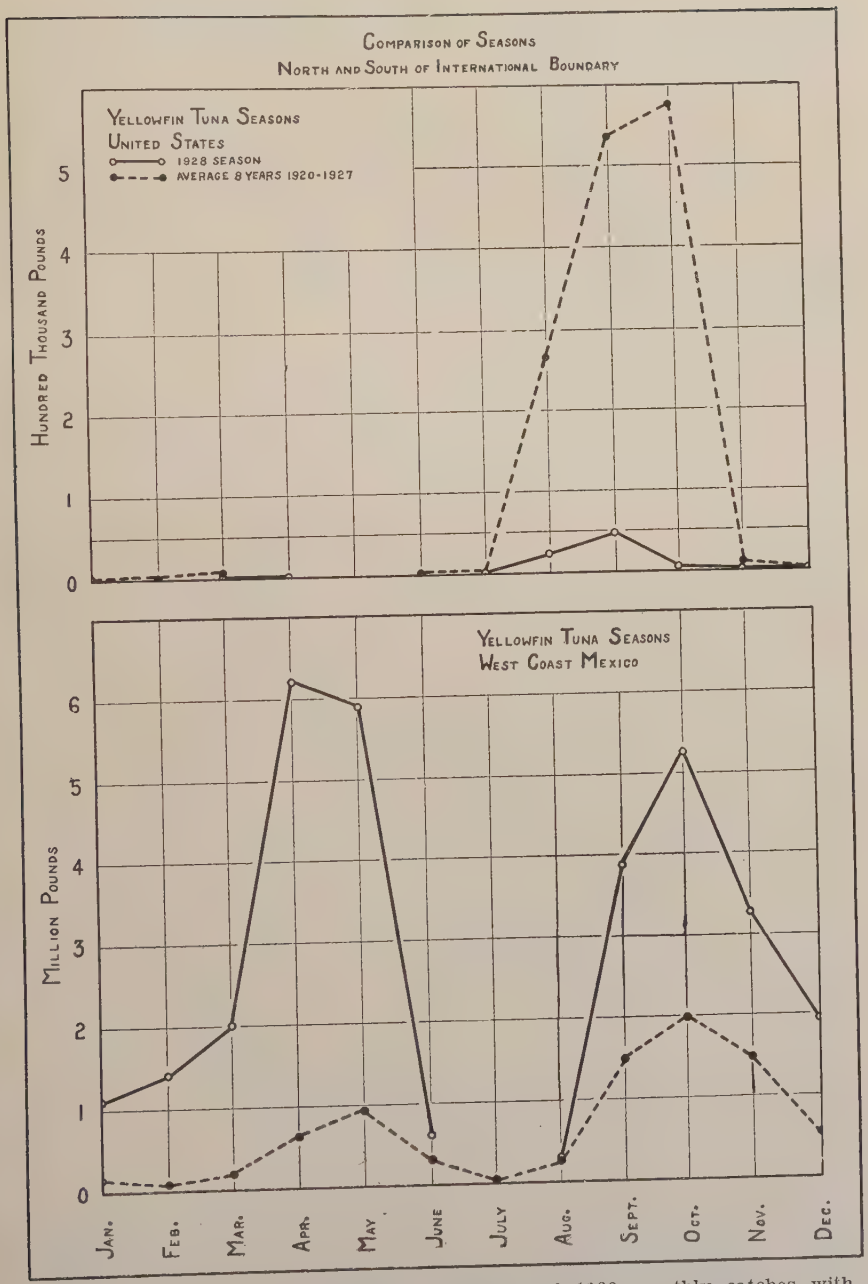

Fig. 58. Yellowfin tuna seasons. Comparison of 1928 monthly catches with averages for the eight-year period from 1920 to 1927, inclusive. (a) United States or California coast. (b) West coast of Mexico.

high in 1928, they have sunk to an insignificant item in the total yellowfin tuna catch. Records for Mexican caught fish show low early years with 1928 far eclipsing them and replacing the California coast as the chief source of supply.

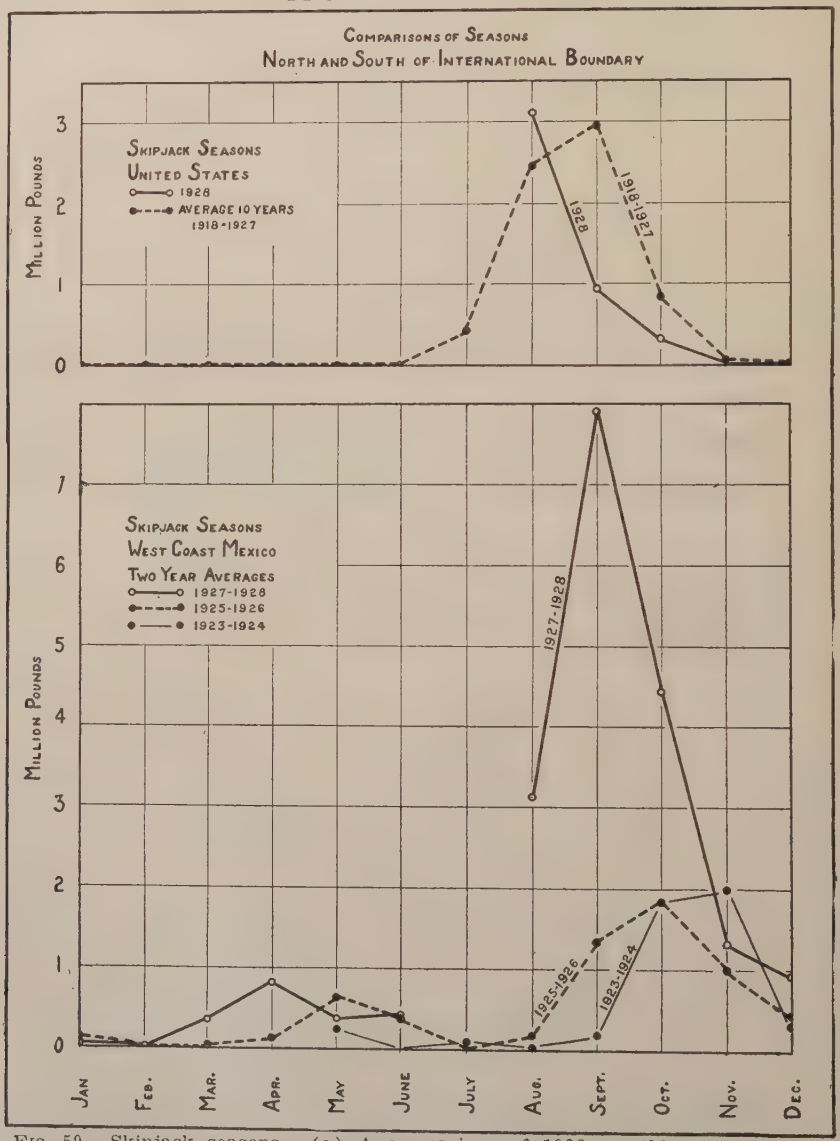

Fig. 59. Skipjack seasons. (a) A comparison of 1928 monthly catches from the waters off the coast of California with average monthly catches for the ten-year period from 1918 to 1927, inclusive. (b) A comparison of the 1927-1928 two-year monthly average catches off the west coast of Mexico with averages for the two-year periods, 1923–1924 and 1925–1926.

We find that the earlier years off the coast of the United States show an average monthly catch of 5,000,000 pounds for September and October, the high months, while in 1928 the greatest catch was made in

September and was less than 500,000 pounds. As stated above the reverse is true concerning the quantities of yellowfin taken off the Mexican coast, the earlier years show an average catch of 1,000,000 and 2,000,000 pounds for the high months of May and October, respectively, while the high months of April and October in 1928 record a catch of 6,000,000 and 5,000,000 pounds, respectively.

Skipjack, second in importance in the 1928 total tuna catch, of necessity has been shown in a different manner for California than that used to show the catch off the Mexican coast. (See figure 59.) The 1928 monthly catches off the coast of the United States have been compared with the average monthly catches for the ten-year period from 1918 to 1927, inclusive. The ten-year average monthly catches for skipjack taken off the California coast show that the greatest quantities are caught between the months of June and November, with the height of the season coming in September, and a few fish are taken each month in the year. The 1928 monthly catches differed from this average procedure in that no skipjack was taken until the month of August when 3,000,000 pounds were caught, making this first month the highest for that year. One-third of that amount was taken in September and the fish became scarcer until only 100 pounds were reported for December.

In the earlier years of the tuna industry, a great deal of the fish was reported to the Division of Fish and Game merely as "tuna." The buyers who made the reports were able to distinguish one from another, but there was confusion concerning the proper name of each variety of tuna. Skipjack was not reported from Mexico in any quantities until 1919 and the first four years, 1919 to 1922, which are shown in our records, give insignificant amounts and perhaps because of the confusion over the names and other difficulties, these figures when plotted would not give a very accurate picture of the true skipjack season for that period. Then too the Mexican skipjack fishery was just developing and the boats were not making regular trips for cannery fish. In studying the monthly catch figures, it was found that a comparison of the averages for two-year periods from 1923 to 1928, inclusive, showed an interesting shift of the season, and this has been plotted in the lower half of figure 59. The monthly catch averages for 1923–1924 show October high, with the peak of the season in November; in the 1925-1926 monthly catch averages, September is high, with the peak in October, one month earlier than it had been in the preceding two-year average. The 1927–1928 peak comes still a month earlier, in September, and it is 6,000,000 pounds greater than any previous average monthly catch. In the 1927–1928 catch average, August and October were also much higher than averages for these months in previous years.

Skipjack is taken in small amounts during every month of the year off the Mexican coast, but from February to June fair catches are made and although they are of little consequence as compared with the heavy fall catches, they are of interest since here also is shown a shift in the season, the high month coming earlier in the later years. For 1923-1924 and for 1925–1926, May was the high month of this spring catch, while in the 1927–1928 monthly catch averages, April surpassed all other spring months.

Summing up the skipjack seasons, we find off the coast of both the United States and Mexico the height of the season comes during the months of August, September and October. The shifting of the season may be entirely due to the fact that the fishing effort is being concentrated on the fishery earlier than it had been in previous years.

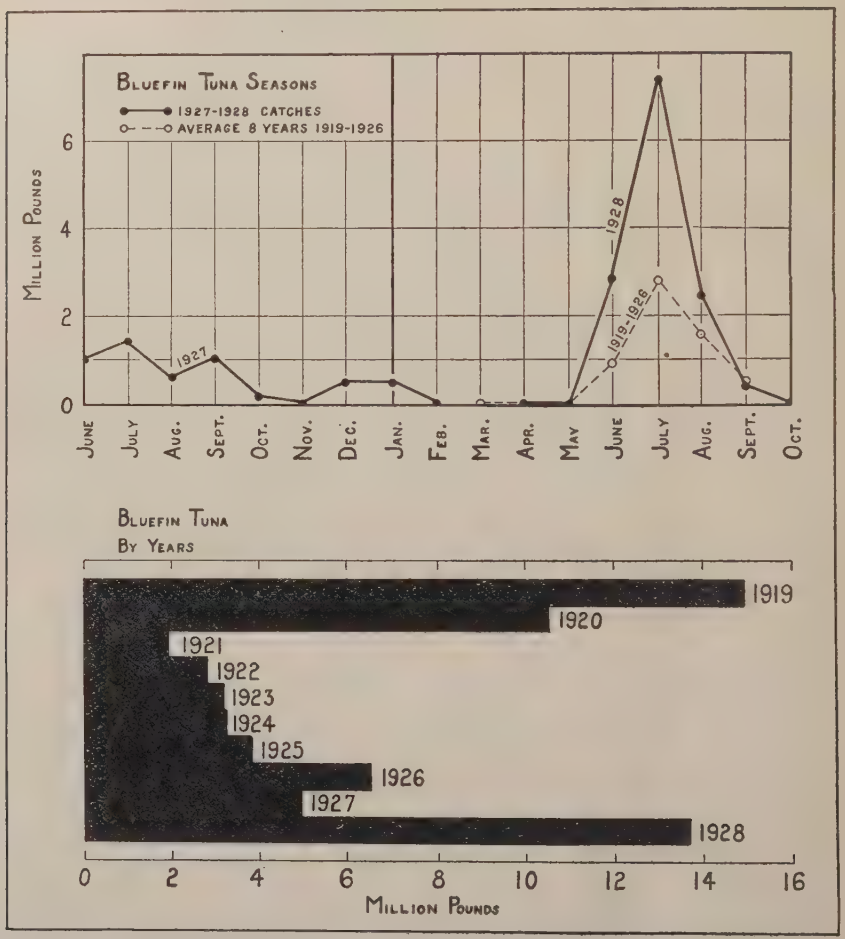

Fig. 60. Bluefin tuna seasons. (a) A comparison of the 1927 and 1928 monthly catches off the coast of the United States with an average of the monthly catches for the eight years from 1919 to 1926, inclusive. (b) Bluefin tuna catches by years.

The large catch of bluefin tuna was one of the outstanding features of the 1928 California fishery events. Bluefin tuna is taken in the northern portion of the tuna fishing area and for this reason the catches are made almost entirely north of the United States-Mexican boundary line off the coast of California. Quantities of bluefin tuna were first reported in our records in 1919. Bluefin was taken prior to that time but merely reported to us as "tuna," unclassified as to species and mixed with other varieties. In 1919, 15,000,000 pounds were taken and the catch for no year since then has come anywhere near that amount until in 1928, when close to 14,000,000 pounds were landed.

(See figure 60.) In 1920, following the high year a good catch of 10,500,000 pounds was reported, but 1921 was the lowest year on record with a catch less than 2,000,000 pounds. After 1921, the catch gradually came up but the increase from year to year was so small it was of no consequence. The splendid 1928 season has renewed interest in the bluefin fishery and has even engendered the hope in fishery circles that the albacore, like the bluefin, may some day again be taken in great quantities off the California coast.

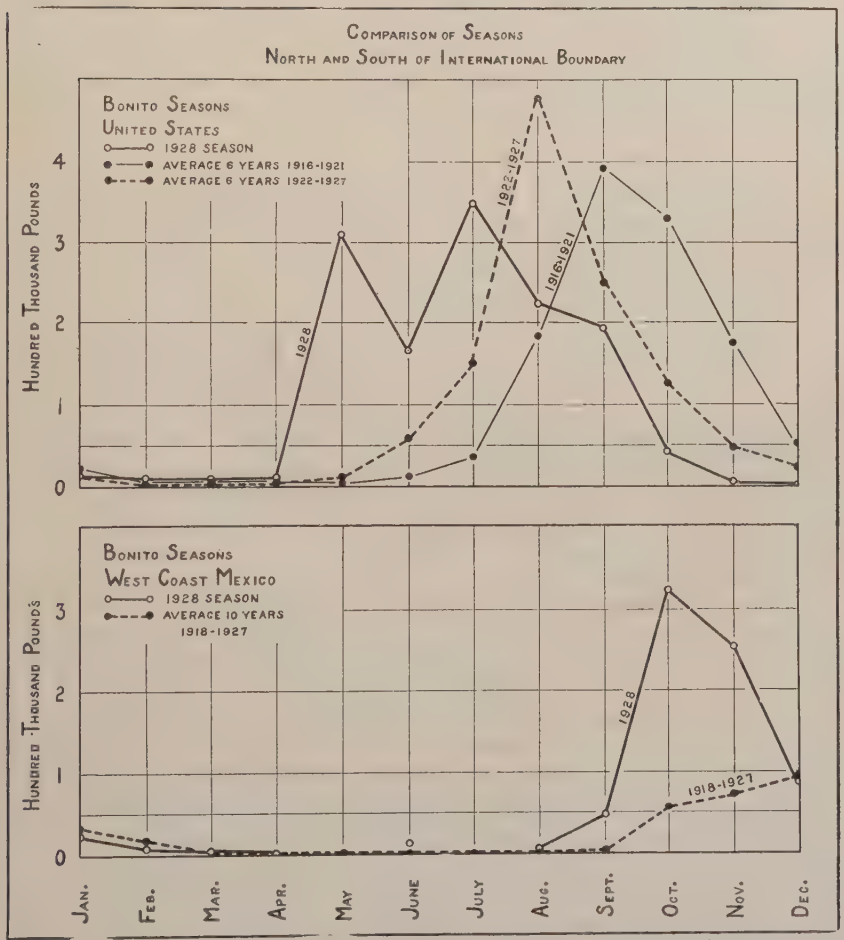

Fig. 61. Bonito seasons. (a) 1928 monthly catches off the coast of the United States compared with two eight-year periods, 1916–1921 and 1922–1928. (b) 1928 catch off the west coast of Mexico compared with average monthly catches for ten-year period from 1918 to 1927, inclusive.

In plotting the monthly catches of bluefin tuna, it was found that the 1927 season differed somewhat from the average season for years previous and also from the 1928 season. As shown in figure 60, the height of the average season for the eight-year period from 1919 to 1926, inclusive, is quite markedly in July while the high months are from May to October with a few fish taken in March and April. The

1928 monthly catch curve follows the average curve, the only difference being for this last year, the peak month was 4,000,000 pounds greater than the average. In 1927, however, no bluefin was taken until June. July as usual was the high month with a catch of about 1,500,000 pounds, much lower than the 1928 July catch. In September a good catch was made and from then on bluefin was reported each month until February, 1928. We have never before had bluefin reported during the winter months from November to February.

The bonito is of less importance than the other tunas. (See figure 61.) It is not taken in as great quantities, possibly because it is not as desirable for canning. It is taken all year and apparently is available in considerable quantities from April to December off the coast of the United States and from August to January off the Mexican coast.

The season off the California coast has been earlier each year, and as with the skipjack off the coast of Mexico, this shifting of season to an earlier period may be caused by the fishermen going out for these fish sooner. They may have been available just as early in previous years but they were not sought by the fishermen.

In the six-year monthly average from 1916 to 1921, inclusive, the heavy catches were made from June to December, with September as the peak month. In the next six-year monthly average from 1922 to 1927, inclusive, the season was from May to December, with August taking first place. The 1928 season ran from April to November and although the peak came in July, one month earlier than the average for the six years previous, there was another high point still earlier. May, which for the twelve years prior had shown very small catches, showed a total of over 3,000,000 pounds so that the large bonito catches for 1928 were made much earlier than ever before and the season extended over a longer period.

The Mexican bonito season for 1928 ran from August to January with the greatest catches being made in October. This, too, is earlier than the average for the twelve-year period preceding, when the season ran from September to March with the high point in December.

The bonito season is more apt to be influenced by the seasons for the other species of tuna. The large bonito catches off the coast of Mexico are made when the boats are in southern waters seeking the yellowfin and skipjack. The large catches off the coast of California appear to be made when other species of tuna are not available.

In comparing the 1928 albacore catch with the average monthly catches for the twelve years just preceding (see figure 62), we get a very clear-cut idea of just how far below the average the 1928 catch of albacore actually was as well as a picture of the season. As shown by the monthly averages for a twelve-year period from 1916–1927, inclusive, the albacore season comes between the months of May and November, with the greatest quantities taken in July. Occasional albacore are landed each month in the year. In spite of the very small catch in 1928, the season for that year ran true to form although shorter than usual, from June to September with July the leading month and no fish reported during the other months of the year. Albacore is seldom caught below the international line and the 1928 catch was made up entirely of locally caught fish, but small amounts from

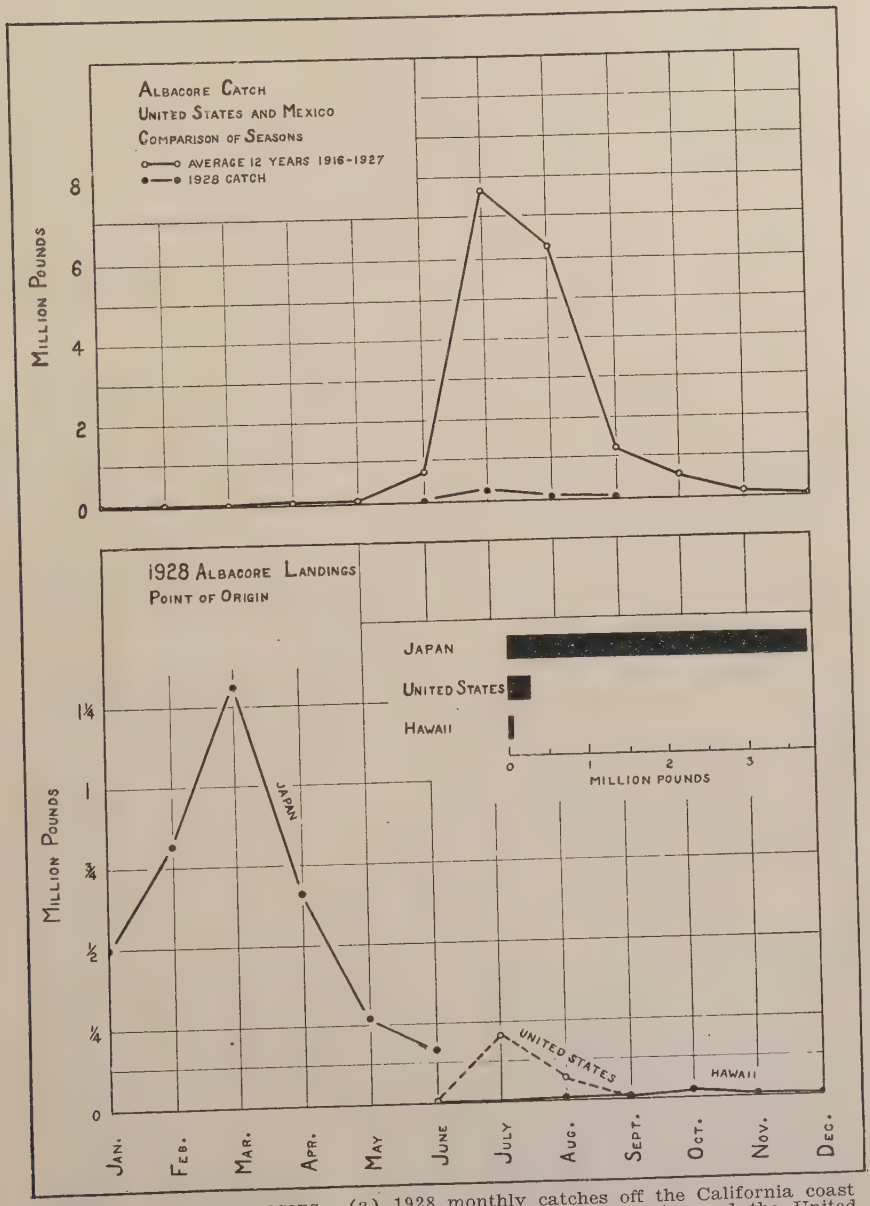

FIG. 62. Albacore seasons. (a) 1928 monthly catches off the California coast compared with average monthly catches of Mexico and the United States combined, covering the twelve-year period, 1916 to 1927, inclusive. (b) 1928 monthly albacore landings in California ports, showing local catches and importations from Japan and Hawaii.

below the boundary have been included with the California catch in the twelve-year averages. Albacore shipments from Japan and Hawaii have not been included in the comparison of the local seasons, since they are from different fishing areas.

The introductory shipments from Japan were made in 1925. In 1927, there were 78,000 pounds imported and packed in the canneries at San Pedro, which proved the commercial success of the experiment. In 1928, a total of 4,000,000 pounds of fresh albacore came to the United States from Japan, and 57,000 pounds from Hawaii. The 3,500,000 pounds from Japan and 8000 pounds from Hawaii imported during the first six months of 1929, would indicate that these shipments will continue to come now that the practicability of importing the fresh fish from such distant places to the canneries in California has been proven.

Importations from Japan for 1928 (as shown in the lower half of figure 62), far surpassed the local albacore catch. The Japanese fish was all received during the early months of the year, from January to June, the greatest amounts coming to California in March. This may be an indication of the Japanese albacore season, but it is hard to tell accurately with so many considerations entering in the case. There is the question of what percentage of the total Japanese catch the 4,000,000 pounds shipped to the United States might be; the Japanese market conditions are also to be taken into account, as well as the arrangements for shipping perishable fish across the Pacific Ocean, the price and the demand in California.

Following the Japanese shipments which were received during the first six months of 1928, from June to September, the local catches of albacore were made, and to complete the discussion of the year most of the Hawaiian fish was received from August to December, with a few in June. Although the Hawaiian shipments have not been very large thus far, it is possible that with a market for the fish in the United States the Hawaiian "Ahi" or albacore fishery will develop to meet this new demand if it is not already being exploited to full capacity. As with the Japanese fish it is difficult to tell whether the date of arrival of albacore shipments from Hawaii, from June to December, would indicate accurately the months when this fish is most abundant in the waters about the Islands. However, it probably is a fair indication of the seasons and it is of interest to note the differences with the height of the Japanese season in the spring, the local fish being taken in the summer months, and the greatest quantities recorded from the Hawaiian Islands in the fall months.

Summing up the 1928 tuna season as a whole, it was a very good year. The total landings in California amounted to approximately 68,500,000 pounds, with 44,500,000 pounds of this amount coming from the waters off the west coast of Mexico; 20,000,000 pounds were locally caught fish, and from Japan and Hawaii there were imported 4,000,000 pounds. The total was above the average for the past thirteen-year period and 1927 is the only year when this amount was exceeded. The 1927 catch was 13,000,000 pounds greater than that for 1928, but the 1928 landings were 11,000,000 pounds greater than the highest amount reported for any year prior to 1927, so that measuring the success of the season from that angle, there is little cause for complaint.

NOTE.—The conclusions which have been drawn above are based on such data for 1928 as are available at this time. There are apt to be slight discrepancies in the total amounts of local and Mexican tuna, which an audit of the books of the California canneries may disclose, but the additions or changes in figures will not be of sufficient consequence to affect the integrity of the information given above. In due course, the additions and corrections of consequence will be printed to supplement the present work.

MONTHLY CATCHES LANDED IN CALIFORNIA BY DISTRICTS FOR 1928

The following tables were compiled from the records received through the medium of the "pink ticket" system of the Bureau of Commercial Fisheries of the Division of Fish and Game of California. There have been included the fish brought into California from the territorial waters of Mexico, from the high seas off the coast of Mexico and Costa Rica, as well as albacore brought from Japan and Hawaii for the southern California canneries.[1] Fishery products counted rather than weighed, were converted into pounds by using the following factors:

Crabs, one dozen	24 pounds
Frogs, one dozen	4 pounds
Terrapins, one dozen	24 pounds
Eastern oysters, one hundred	22 pounds
Ecrevisse, one dozen	3 pounds

The point of origin has been shown for the species which are not taken entirely in local waters, and also the amounts imported from each fishing area.

DEL NORTE AND HUMBOLDT COUNTIES

1928

Species of fish	January	February	March	April	May	June	July	August	September	October	November	December	Total
Cultus Cod	135	33	90	6,676	383	2,432	5,484	22,404	6,099	652	40	38	44,466
Flounders	3,900	5,008	2,373	539							290	110	12,220
Halibut		35,949	27,904	48,745	35,648	28,421	21,083	31,087	47,804	34,985	8,564		320,190
Herring	29,436	32,006											61,442
Perch	2,238	4,871	7,029	16,883	235	761	3,940				762	1,595	38,314
Rockfish	32	15,514	5,587	12,077	5,333	5,832	4,637	4,295	16,663	11,357	1,062	531	82,920
Sablefish	1,043	2,801	84,580	103,149	5,526	13,700	15,588		48,098	96,024	14,316		384,825
Salmon						153,581	185,315	633,881	101,620	58,753	78,450		1,211,600
Sardines						87							87
Smelts	753	8,935	15,925	12,103	9,694	9,536	1,272	1,599	1,482	1,506	30		62,835
Sole				210	339	944	258	755	1,386	53			3,945
Whitebait	330	1,525	7,140	26,400	35,304	17,863	11,059	325	290				100,236
Miscellaneous			136	406		1,083	1,967				85		3,677
Crabs	11,688	18,720	16,776	8,016	6,000	6,408	8,016				2,352	6,984	84,960
Clams—Mixed	673	1,137	1,079	716				60	2,596	1,683	527	454	8,925
Totals	50,228	126,499	168,619	235,920	98,462	240,648	258,619	694,406	226,038	205,013	106,478	9,712	2,420,642

[1] See table of "Totuava Importations, 1928," on page 109.

MENDOCINO, SONOMA AND LAKE COUNTIES

1928

Species of fish	January	February	March	April	May	June	July	August	September	October	November	December	Total
Carp				32,225	42,669								74,894
Catfish	11,823	21,884	20,876						1,859	6,337	5,891	5,856	74,626
Cultus Cod	780	1,560	4,420	3,510	2,080	2,919	8,789	17,994	15,918	8,417	780	2,080	68,347
Flounders	5,070	3,380	2,340	1,560	13,070	5,740	4,610	900	2,210	3,900	1,220	2,470	46,470
Grayfish							260						260
Halibut				130		4,334	13,813	11,212	981	257			30,727
Hardhead				1,875	9,215								11,090
Perch	2,696	455											3,151
Rockfish	4,540	3,610	1,950	780	1,950	1,641	230	532	255	4,316	2,080	2,460	24,344
Sablefish							360						360
Salmon						544,225	543,756	422,771	51,963				1,562,715
Sandabs	4,030	4,190	4,810	5,980	5,200	4,830	130	130	780	1,690	1,690	1,820	35,280
Skates	1,040					130	780	390					2,340
Smelt		91							235				326
Sole	25,200	42,730	30,860	28,220	22,290	21,600	456		3,830	13,530	14,140	16,540	219,396
Whitebait						2,605	13,189	686					16,480
Miscellaneous	130	910		130	260		29	190	260	260	650	260	3,079
Crabs	120	1,008											1,128
Clams– Cockle		75			32			150					257
Clams– Mixed					45								45
Clams– Softshell		140	145	85	65			14	120				569
Totals	55,429	80,033	65,401	74,495	96,876	588,024	586,402	454,969	77,611	38,707	26,451	31,486	2,175,884

MARIN COUNTY

1928

Species of fish	January	February	March	April	May	June	July	August	September	October	November	December	Total
Cultus Cod								240			125		365
Halibut						37	27						64
Herring	197,440	163,060	150	15							2,905	77,903	441,473
Perch	8,303	11,536	10,341	13,388			369	1,495	2,564	3,494	2,595	3,073	57,158
Rockfish								285					285
Sea Bass—White							36	2,470	5,300	9,824	361	89	18,080
Smelt	100	2,158	2,004	1,948	2,705	4,328	13,552	8,698	1,594	3,876	3,098	92	44,153
Striped Bass												90	90
Turbot	131		4	93	720	1,268	391				52		2,659
Whitebait		19	144	28					20			22	233
Shrimps	46,308	81,024	155,412	158,665	127,979	221,682	283,144	256,235	206,278	191,250	123,921	80,249	1,932,147
Clams—Cockle		10	611	2,795	2,022	1,173	4,973	4,084	1,539	979	1,441	2,767	22,394
Clams—Mixed	4,383	4,738	3,677	7,784	7,247	5,888		305					34,022
Clams—Softshell	8,805	10,007	9,194	5,600	5,260	5,340	8,218	8,791	8,628	5,200	5,600	6,296	86,939
Oysters—Eastern	17,496	48,274	34,281	29,970	28,818	23,848	14,793	21,312	25,570	55,646	65,818	62,152	427,978
Totals	282,966	320,826	215,818	220,286	174,751	263,564	325,503	303,915	251,493	270,269	205,916	232,733	3,068,040

SOLANO AND YOLO COUNTIES

1928

Species of fish	January	February	March	April	May	June	July	August	September	October	November	December	Total
Carp	302	571	3,318	3,948	3,408			302			18	175	12,042
Catfish		652	1,113	2,525	538			150	403	1,027	691		7,099
Flounders		25											25
Pike	20	10	7	12								108	157
Salmon	103	111	1,715	6,115	4,145	112		32,323	71,409		326	126	116,485
Shad	7	40	7	64	10			6			997	503	1,634
Shad—Buck			8,411	53,798	53,844								116,053
Shad—Roe			6,700	81,065	129,515			3	3				217,286
Striped Bass	1,668	1,496	2,589	9,023	10,300			7,238	1,854		3,679	5,865	43,712
Miscellaneous					30			30					60
Totals	2,100	2,905	23,860	156,550	201,790	112		40,052	73,669	1,027	5,711	6,777	514,553

SACRAMENTO AND SAN JOAQUIN COUNTIES

1928

Species of fish	January	February	March	April	May	June	July	August	September	October	November	December	Total
Carp	9,600	5,948	6,769	3,716	265	258	90	2,075	913	227	2,091	5,078	37,028
Catfish	2,623	6,149	25,577	45,280	14,755			18,447	31,281	35,203	28,351	18,090	225,756
Flounders									65				65
Hardhead	17,255	2,896	2,096	245					50	315	11,256	16,496	50,609
Pike	192	590	771	47		24		26	83		62	141	1,936
Salmon	8	1,138	6,523	13,216	26,179	4,981		60,676	67,633		274	51	180,679
Shad			56	188							245		489
Shad—Buck			4,090	20,518	14,201			1,756			72		40,637
Shad—Roe		4	3,494	28,014	30,405			15					61,932
Splittail	2,451	3,019	1,753	45							1,861	1,139	10,268
Striped Bass	6,449	7,537	14,207	28,121	42,242			4,665	3,643		7,823	11,646	126,333
Suckers	240	544	185	49									1,018
Miscellaneous	50										34		84
Terrapin					168								168
Totals	38,868	27,825	65,521	139,439	128,215	5,263	90	87,658	103,668	35,745	52,069	52,641	737,002

ALAMEDA AND CONTRA COSTA COUNTIES

1928

Species of fish	January	February	March	April	May	June	July	August	September	October	November	December	Total
Carp	774	1,787	7,698	9,970	3,870	1,139	1,566	3,137	541		1,268	713	32,463
Catfish	7,450	6,289	15,041	27,528	6,971			16,829	17,210	19,440	24,535	10,327	151,620
Herring	9,075	11,250										2,550	22,875
Perch				3									3
Pike	209	179	257	169	65			3	12		307	486	1,687
Salmon	50	339	4,410	17,800	18,979	2,481		33,184	178,186		909	275	256,613
Shad	18	311	184	15				5,187	55		3,190	786	9,746
Shad—Buck		39	26,544	326,104	256,477	127		1,975	54		243	51	611,614
Shad—Roe		26	22,600	430,104	493,811	60					16		946,617
Smelt				16	30					531			577
Splittail		67		230					175				472
Striped Bass	8,633	23,706	44,156	67,691	38,542			51,070	12,219		22,377	30,157	298,551
Suckers	8	3											11
Miscellaneous		4		7	28			23					62
Crabs												312	312
Clams—Softshell	3,975	3,575	3,762	1,970	2,446	2,875	3,854	4,918	4,287	3,610	4,410	4,265	43,947
Mussels				60	20								80
Totals	30,192	47,575	124,652	881,667	821,239	6,682	5,420	116,326	212 739	23,581	57,255	49,922	2,377,250

SAN FRANCISCO AND SAN MATEO COUNTIES

1928

Species of fish	January	February	March	April	May	June	July	August	September	October	November	December	Total
Anchovies				360	22,975	29,450		40,670	27,850	4,210			125,515
Carp		11	105	505	235								856
Cultus Cod	25,842	40,654	85,190	68,426	22,729	31,322	25,692	36,646	67,998	70,390	15,419	34,044	524,352
Eels			5										5
Flounders	3,727	16,212	57,511	26,173	27,579	8,770	64,955	30,040	14,107	40,594	5,065	3,775	298,508
Grayfish	48,210	25,135	30,680	17,060	1,735	810	15,231	7,920	19,520	40,374	40,660	153,143	400,478
Hake				450	9,705	11,580	22,435	6,980	3,150	6,308	14,162	1,277	76,047
Halibut	1,610	991	558	1,185	994	1,122	960	3,650	6,004	6,394	592	799	24,859
Herring	237,050	171,500	94,070	12,310				1,000				74,300	590,230
Kingfish	375	125	125	1,860	470	1,993	11,052	4,379	1,814	2,377	1,760	455	26,785
Mackerel									135	35	1,772	320	2,262
Perch		150	1,139	3,278	294		4,776	8,030	3,671	4,646	3,617	234	29,835
Rockfish	86,486	81,880	86,838	99,118	68,079	110,944	69,608	64,613	106,375	71,914	74,868	77,250	997,973
Sablefish	31,956	73,090	43,229	2,548	950	9,803	7,244	32,458	60,906	18,917	44,022	16,906	342,029
Salmon			31		8,048	239,278	448,469	119,799	190				815,815
Sandabs	65,563	79,040	78,598	46,970	66,564	54,735	103,663	60,642	59,161	97,001	65,259	66,010	843,206
Sardines	2,439,893	2,576,576	324,625	470	57,880	194,200	170,800	1,688,763	3,072,738	5,368,897	5,664,947	5,405,947	26,965,736
Sea Bass—White								34	6,522	11,127	152		17,835
Shad			130	22,560	60,180								82,870
Skates	23,800	17,364	36,765	17,975	15,875	10,660	20,909	17,451	21,102	44,139	38,927	50,550	315,517
Smelt		8,522	13,437	7,309	9,234	3,109	3,587	5,956	11,035	6,612	175		68,976
Sole	882,314	989,938	731,129	696,494	551,503	340,394	553,035	620,519	701,845	700,514	523,075	667,940	7,958,700
Striped Bass		492	2,409	6,782	3,204			1,634	906				15,427
Tomcod				125			32	8,218	1,973	1,105	345		11,798
Turbot						900	3,925	900	250	300	300		6,575
Whitebait			215	1,166	7,516	40	797	2,295	1,153	927	279		14,388
Miscellaneous	3,750	3,530	6,200	1,320	2,100	2,137	2,963	3,316	440	1,975	900	1,177	29,808
Crabs	384,960	391,152	159,528	357,888	373,272	332,784	263,472				342,024	409,368	3,014,448
Shrimps	26,699	25,573	32,959	24,656	50,506	40,670	32,760	39,457	25,508	14,866	16,751	18,319	348,724
Clams—Softshell		497	1,311	1,165	1,201	610	737	1,197	801	3,159	2,900	3,389	16,967
Cuttlefish	30	28	405	146	69	145	779	628	147	76		100	2,553
Mussels	35	60	65										160
Oysters—Eastern	22,495	10,780	35,200	32,395	26,455	19,415	19,635	10,670	27,775	18,436	32,384	42,680	298,320
Oysters—Native					4,900	5,400	5,350	3,650	2,500	1,900	1,750	1,400	26,850
Totals	4,284,795	4,513,300	1,822,457	1,450,694	1,394,252	1,450,271	1,852,866	2,821,515	4,245,576	6,537,193	6,892,105	7,029,383	44,294,407

SANTA CRUZ COUNTY

1928

Species of fish	January	February	March	April	May	June	July	August	September	October	November	December	Total
Anchovies						106							106
Barracuda									21				21
Bonito				90					506				596
Cultus Cod	754	669	642	8,438	21,852	32,049	5,927	7,349	5,330	6,120	1,758	3,300	94,188
Flounders	109	30	1,542	2,596	10,475	8,467	10,700	1,349	3,500		1,000	87	39,855
Grayfish			125		1,075	5,455	7,570	810	1,375		6,005	2,125	24,540
Hake				300	8,325	10,572	10,659	915			125	1,625	32,521
Halibut	181	123	108	141	494	749	945	374	32	16	385	204	3,752
Herring												125	125
Kingfish		1,555	1,534	4,070	2,816	3,897	7,044	3,364	228	3,414	1,593	1,002	30,517
Mackerel		18		390	265	186	175	147	410	889			2,480
Perch			625	3,615				10	1,258	13	9		5,530
Pompano						6							6
Rockfish	7,412	32,880	11,752	36,377	100,832	77,828	143,020	119,078	78,857	49,218	20,875	8,856	686,985
Sablefish		4,015	109	21,055	4,747	1,500	1,329	7,593	15,332	30,405	28,001	32,457	146,543
Salmon				14,642	6,532	27,350	26,291	431					75,246
Sandabs	128		250	6,500	49,410	51,736	39,229	33,148	2,311		12,427	7,250	202,389
Sardines		200			800	155		193	40	93		157	1,638
Sculpin				182	177				763	456	10	141	1,729
Sea Bass—White		57						356	21,831	160			22,404
Skates			1,500	5,500	6,575	8,969	8,807	4,519	1,687		3,955	500	42,012
Skipjack								32	1,072	82			1,186
Smelt			4,954	18	16,480	20,740	20,901	31,517	16,563	7,573	286	39	119,971
Sole	1,253	601	8,845	105,978	354,262	316,057	221,052	231,878	20,219	5	190,139	61,089	1,511,378
Tomcod					125								125
Miscellaneous	497		18	291	2,437	2,352	519	2,037	459			671	9,281
Crabs	100,752	209,040	62,976	35,830	6,000						21,960	21,120	457,728
Clams—Pismo												45	45
Cuttlefish		18	25	303	32	10	312					25	725
Totals	111,086	249,206	95,005	246,366	593,711	568,184	504,480	445,160	171,794	98,444	288,528	140,818	3,512,722

MONTEREY COUNTY

1928

Species of fish	January	February	March	April	May	June	July	August	September	October	November	December	Total
Albacore								180					180
Anchovies				5,791	143,134	12,380	10,790	1,315		1,800		170	175,380
Barracuda	7									808	60	88	963
Bonito	110												110
Cultus Cod	10,262	7,282	4,441	7,638	5,980	3,752	3,382	3,829	10,211	11,822	18,577	33,597	120,773
Flounders	75	95		50		150	264	47	100		165	312	1,258
Grayfish	650			750		50			29,400	14,150	11,700		56,700
Hake						80							80
Halibut	546	296	2,782	635	139	1,959	4,721	606	600	1,238	2,875	1,518	17,915
Herring				200		100	140						440
Kingfish	8,284	8,973	4,324	4,616	4,141	9,239	2,845	370			8,124	10,061	60,977
Mackerel	136,123	138,074	88,238	16,084	116,080	160,424	107,767	102,197	138,555	153,463	112,371	25,058	1,294,434
Mackerel—Horse	17	10	373	1,438	168	245	1,495	140	3,400	21,465	193		28,944
Perch	285	502	799	7,567			7,419	128	452	110	214	1,056	18,532
Pompano				2,148	49								2,197
Rockfish	191,006	251,870	86,474	124,173	140,853	73,538	39,733	69,348	145,372	236,380	128,804	111,808	1,599,359
Sablefish			724	1,409	2,582	5,835	986	326	8,686	4,982	5,343	5,652	36,525
Salmon				87,353	50,003	89,503	32,441	108					259,408
Sandabs	2,114	2,202	3,226	503	296	370	523	206	689	153	1,153	253	11,688
Sardines	19,519,310	55,087,150	5,892,215	20,568	42,120	127,135	38,811	43,945,505	49,884,420	34,143,176	4,344,960	8,521,270	221,566,640
Sculpin			10				32	65	3		749	40	899
Sea Bass—White							5	3,099	82		274	30	3,490
Skates	1,297	3,683	8,135	6,014	2,770	350	2,275	10	13,000	12,150	20,360	494	70,538
Skipjack					8								8
Smelt	952	40	431	2,468	441	18,364	8,996	1,329	9,114	5,757	2,896	1,643	52,431
Sole	33,703	25,551	24,177	58,166	41,474	29,525	40,168	3,170	17,037	11,242	14,875	478	299,566
Whitebait			15	809	345	1,352	1,253			71	4		3,849
Miscellaneous		197	779	2,347	561	589	56	2,734	931	755	1,382	930	11,261
Crabs	4,416	1,176	5,352	4,056	744	72						72	15,888
Abalones			121,900	278,050	115,525	398,750	368,275	179 700	266,325	188,700	29,550	103,100	2,049,875
Clams—Mixed		485	492				40						1,017
Clams—Pismo		240	188	331					37	199	430	685	2,110
Clams—Softshell									120				120
Cuttlefish	74	41	60	248	621	1,135	1,018	423	1,545	1,044	103	92	6,404
Mussels	180	180	550	240		220							1,370
Squid	6,015	61,868	214	73,067	837,427	279,733	39,876				53,094	698	1,351,992
Totals	19,915,426	55,589,915	6,245,899	766,719	1,505,461	1,214,850	713,311	44,314,835	50,530,079	34,869,465	4,758,256	8,819,105	229,123,321

SAN LUIS OBISPO, SANTA BARBARA AND VENTURA COUNTIES

1928

Species of fish	January	February	March	April	May	June	July	August	September	October	November	December	Total
Albacore								190					190
Barracuda				1,829	2,485	5,199	633	2,155	2,190	147			14,638
Bonito	8							187	230	99		13	537
Cultus Cod	50							96	114	20			280
Halibut	31,517	21,376	15,131	26,349	13,919	16,557	26,279	23,291	20,739	15,674	13,314	24,207	248,353
Herring	490											80	570
Mackerel	1,563	2,282	890	372	753	674	259	1,823	1,847	794	1,215	1,270	13,742
Perch	186	207		92			635	657	355	948	40	113	3,233
Rock Bass	2,090	901	592	912	36	139		1,765	678	1,035	325	327	8,798
Rockfish	8,302	21,600	13,460	9,826	9,645	5,675	9,035	7,442	5,337	3,109	2,468	6,947	102,846
Sablefish	84	6											90
Salmon							5						5
Sardines				100	100		15			97			312
Sculpin	25			11	57								93
Sea Bass—Black							270	339				220	829
Sea Bass—White	657	74			259	6,236	16,997	29,886	17,268	4,477	2,984	941	79,779
Sheepshead	11	7		475	500		195	165	4,840	235	170	172	6,770
Skipjack										112			112
Smelt	3,729	6,139	11,716	10,046	4,598	3,770	2,029	7,532	5,052	61	580	1,186	56,438
Sole	14,939	6,639	8,626	22,636	34,269	39,370	29,505	20,040	16,337	7,475	6,045	13,060	218,941
Whitefish							70						70
Yellowtail									71				71
Miscellaneous	52	70		171			200	835	1,039				2,367
Spiny Lobsters	12,689	9,624								14,243	7,124	11,243	54,923
Abalones			1,581	4,668	3,130	1,394	863	373		109	573	3,677	16,368
Clams—Pismo	7,394	7,359	7,377	8,270	10,238	14,711	18,290	15,028	11,295	10,447	6,589	6,679	123,677
Totals	83,786	76,284	59,373	85,757	79,989	93,725	105,280	111,804	87,392	59,082	41,425	70,135	954,032

LOS ANGELES COUNTY

1928

Species of fish	January	February	March	April	May	June	July	August	September	October	November	December	Total
Albacore—													
Local	90		258				180,599	72,078	851				253,876
Hawaii						8,616		10,793	7,468	18,146	6,521	5,909	57,453
Japan	495,268	813,207	1,318,359	665,318	265,793	159,636						7,374	3,724,955
Totals	495,358	813,207	1,318,617	665,318	265,793	168,252	180,599	82,871	8,319	18,146	6,521	13,283	4,036,284
Anchovies	1,190	155		15,666	21,226	4,860	707	895	2,260	3,895	345	175	51,374
Barracuda—													
Local	1,484	896	44,121	667,312	1,005,366	456,328	584,229	585,757	81,237	22,200	5,597	11,113	3,465,550
West Coast of Mexico	199,750	115,499	213,236	2,533					90,789	599,190	307,777	274,264	1,713,038
Totals	201,234	116,395	257,357	669,845	1,005,366	456,328	584,229	585,757	172,026	531,390	313,284	285,377	5,178,588
Bonito—													
Local	13,211	657	745	4,404	17,115	70,867	140,021	183,529	174,691	38,948	3,254	365	647,807
West Coast of Mexico	15,549	7,023	110					6,138	40,035	317,073	249,409	76,308	711,645
Totals	28,760	7,680	855	4,404	17,115	70,867	140,021	189,667	214,726	356,021	252,663	76,673	1,359,452
Cabrilla—													
West Coast of Mexico												1,575	1,575
Corvina—													
Gulf of Lower California	3,305		6,802	4,267									14,374
Cultus Cod	124	276			99	42			41	145			727
Eels					222								222
Flounders			20	63	59	175	127	147	622	116	119	15	1,463
Grayfish	6,341	5,058	5,830	14,809	17,009	10,772	10,056	10,671	14,735	19,099	9,953	4,524	127,957
Halibut—													
Local	34,775	79,746	85,781	83,497	44,131	22,535	15,289	35,943	30,532	26,101	11,405	9,194	478,929
West Coast of Mexico		55								412	689	22	1,178
Totals	34,775	79,801	85,781	83,497	44,131	22,535	15,289	35,943	30,532	26,513	12,094	9,216	480,107
Kingfish	52,641	40,138	38,861	36,054	24,296	19,590	9,813	9,783	11,482	24,122	24,790	33,492	319,062
Mackerel	415,043	422,289	549,432	307,298	1,106,477	399,972	2,223,931	4,025,803	5,131,270	8,047,660	3,752,488	3,491,014	29,872,677
Mackerel, Horse—													
Local	22,529	39,483	23,760	3,360	11,726	31,695	63,126	66,923	76,312	64,840	50,686	54,892	509,332
West Coast of Mexico			200						162		800	744	1,906
Totals	22,529	39,483	23,960	3,360	11,726	31,695	63,126	66,923	76,474	64,840	51,486	55,636	511,238
Mullet—													
Local					133		1,110	2,095	280				3,618
West Coast of Mexico	6,459												6,459
Totals	6,459				133		1,110	2,095	280				10,077

Perch—													
Local	4,423	3,720	5,054	17,040	2,065	3,409	7,273	4,674	7,431	10,316	5,058	3,682	74,145
West Coast of Mexico		62	250										312
Totals	4,423	3,782	5,304	17,040	2,065	3,409	7,273	4,674	7,431	10,316	5,058	3,682	74,457
Pompano—													
Local	1	22	29	74	119	66	65	22	217	101	126	18	860
West Coast of Mexico	1,286												1,286
Totals	1,287	22	29	74	119	66	65	22	217	101	126	18	2,146
Rock Bass—													
Local	10,471	9,469	10,253	11,885	24,952	41,920	70,221	49,576	23,405	13,096	7,688	2,659	275,595
West Coast of Mexico				100							250	7,139	7,489
Totals	10,471	9,469	10,253	11,985	24,952	41,920	70,221	49,576	23,405	13,096	7,938	9,798	283,084
Rockfish	83,425	217,371	229,230	160,394	162,030	151,350	107,139	115,026	89,919	143,067	74,085	122,711	1,655,747
Sablefish	630	1,895	1,738	307	940	304	347	384			23		6,568
Sandabs	1,607	1,348	1,504	1,895	1,691	823	1,294	1,416	2,193	409	1,300	713	16,193
Sardines	17,486,619	35,260,248	35,370,132	3,891,723	2,245,460	9,239	20,919	8,875	42,183	7,138,780	30,212,223	32,930,434	164,616,935
Sculpin	2,259	912	1,363	1,824	7,738	1,683	4,139	12,858	15,767	6,469	2,912	1,991	59,915
Sea Bass—Black—													
Local	1,072	812	662	726	923	1,628	3,697	7,318	6,645	5,739	3,009	242	32,473
Gulf of Lower California												410	410
West Coast of Mexico	1,220	796	135						358	2,480	578	5,590	11,157
Totals	2,292	1,608	797	726	923	1,628	3,697	7,318	7,003	8,219	3,587	6,242	44,040
Sea Bass—White—													
Local	1,866	942	4,388	76,425	99,215	29,919	72,845	118,142	56,498	5,429	16,136	16,479	498,224
West Coast of Mexico	1,881	572	10,295						12,827	57,135	45,794	1,817	130,321
Totals	3,687	1,514	14,683	76,425	99,215	29,919	72,845	118,142	69,325	62,564	61,930	18,296	628,545
Sheepshead—													
Local	64,372	56,479	21,201	12,565	12,320	2,305	1,679	13,665	27,593	28,355	48,663	38,848	328,045
West Coast of Mexico												188	188
Totals	64,372	56,479	21,201	12,565	12,320	2,305	1,679	13,665	27,593	28,355	48,663	39,036	328,233
Skates	3,310	4,118	2,709	2,418	773	450	348	1,712	3,144	2,447	1,622	2,345	25,396
Skipjack—													
Local								826,122	406,533	186,128	630	100	1,419,513
West Coast of Mexico	4,815		265,554	608,292	403,622	109,693		165,498	1,935,186	1,291,799	379,458	52,164	5,216,081
Totals	4,815		265,554	608,292	403,622	109,693		991,620	2,341,719	1,477,927	380,088	52,264	6,635,594
Smelt—													
Local	57,915	38,402	36,347	34,130	33,988	26,086	29,253	37,038	19,462	26,052	26,352	34,167	399,192
West Coast of Mexico	75											1,092	1,167
Totals	57,990	38,402	36,347	34,130	33,988	26,086	29,253	37,038	19,462	26,052	26,352	35,259	400,359
Sole	1,060	2,623	5,143	783	201	138	53	17,437	21,362	7,386	771	1,894	58,851
Swordfish						1,134	4,797	2,626	39,318	16,874	38,323	246	103,318

LOS ANGELES COUNTY—Continued

Species of fish	January	February	March	April	May	June	July	August	September	October	November	December	Total
Totuava—													
Gulf of Lower California	247 861	212,059	183,342	31,169	39,973	2,141				19,476	42,258	63,078	841,357
Tuna—Bluefin	532,543	332		4,467	2,547	2,475,837	5,719,141	2,444,571	412,974				11,592,412
Tuna—Yellowfin—													
Local	1,320		300	320			25	20,770	47,814	6,279	1,365	1,120	79,313
West Coast of Mexico	23,275	210,818	659,708	4,478,799	4,409,582	433,843		101,541	1,615,908	2,390,250	937,534	135,974	15,397,232
Totals	24,595	210,818	660,008	4,479,119	4,409,582	433,843	25	122,311	1,663,722	2,396,529	938,899	137,094	15,476,545
Whitefish—													
Local	21,291	11,234	2,986	6,107	3,878	2,828	8,450	2,001	8,354	5,880	12,297	17,918	103,224
West Coast of Mexico	277	2,928	38								195	1,092	4,530
Totals	21,568	14,162	3,024	6,107	3,878	2,828	8,450	2,001	8,354	5,880	12,492	19,010	107,754
Yellowtail—													
Local	567	10,214	14,549	3,462	30,650	8,839	5,368	84,433	91,017	5,621	24,847	7,439	287,066
West Coast of Mexico	30,868	53,971	138,694	22,462		7.173		11,927	32,284	106,132	100,560	17,299	521,370
Totals	31,435	64,185	153,243	25,924	30,650	16,012	5,368	96,360	123,301	111,753	125,407	24,738	808,376
Miscellaneous—													
Local	7,812	6,421	4,632	4,780	13,807	23,054	18,305	13,306	10,411	9,445	4,406	3,868	120.247
West Coast of Mexico	4,315	230										617	5,162
Totals	12,127	6,651	4,632	4,780	13,807	23,054	18,305	13,306	10,411	9,445	4,406	4,485	125,409
Crabs				63	207								270
Spiny Lobsters—													
Local	26,306	18505	299							43,495	27,509	35,625	151,739
West Coast of Mexico												350	350
Totals	26,306	18,505	299							43,495	27,509	35,975	152,089
Clams—Mixed	213		28	213			124	50			25		653
Cuttlefish			19	27									46
Grand totals	19,892,654	37,650,985	39,258,097	11,171,031	10,010,333	4,519,050	9,304,490	9,071,543	10,591,570	20,620,587	36,438,840	37,480,289	246,009,469

ORANGE COUNTY

1928

Species of fish	January	February	March	April	May	June	July	August	September	October	November	December	Total
Albacore						18	4,013	891					4,922
Anchovies				590		2,008	534	663	570				4,365
Barracuda	42		72	725	15,200	18,916	15,594	2,027	5	970			53,551
Bonito	43			12	2,263	839	1,832	739	142				5,870
Cultus Cod	20				19								39
Flounders							6	10					16
Grayfish		10	107	50	10	128	35	10	72				422
Halibut	3,961	7,772	20,717	11,278	2,550	1,841	281	460	407	4	88	43	49,402
Kingfish	118	50	4			27	40					60	299
Mackerel	79,991	32,782	113,078	174,555	250,283	44,849	170,474	129,148	43,000	14,734	67,627	237,133	1,357,654
Mackerel—Horse	170												170
Mullet								1,595	271		11		1,877
Perch								15					15
Rock Bass	7,526	10,359	6,603	15,383	10,287	23,726	12,934	9,706	14,187	12,354	4,723	5,706	133,494
Rockfish	13,459	15,486	3,495	1,599	487	1,409	257	1,634	2,566	235	801	48	41,476
Sablefish											15		15
Sandabs							8						8
Sardines				200		917	300	100	220	20			1,757
Sculpin	66	148	118		28					35	573	119	1,087
Sea Bass—Black	1,253	3,375	1,902	5,179	8,987	262	701	275	890	6,718	2,424	828	32,794
Sea Bass—White	1,663	777	800	308	253	863	661	1,721	38	1,051	2,819	2,620	13,574
Sheepshead	977	478	73	11	90	208	5	150	86	216	501	30	2,825
Skates	31	74	131	153									389
Smelt	246	144	48	62		63			20,322	25,805	31,090	10,134	87,914
Sole	437	715	536	201	120	54	15	148	33				2,259
Swordfish											487		487
Tuna—Bluefin	23					21	33						77
Tuna—Yellowfin								49					49
Whitefish		87								35	288	16	426
Yellowtail	97			18	286	388	277	492	3,544	42	7		5,151
Miscellaneous	257	95	2	319	9	42	130	119	105	8	713	10	1,809
Spiny Lobsters	1,337	867								4,233	5,979	4,897	17,313
Cuttlefish	4												4
Totals	111,721	73,219	147,686	210,643	290,872	96,579	208,130	149,952	86,458	66,460	118,146	261,644	1,821,510

SAN DIEGO COUNTY—Continued

Species of fish	January	February	March	April	May	June	July	August	September	October	November	December	Total
Yellowtail—													
Local	64	171	3,082	4,058	126,801	76,689	116,656	341,547	189,858	143,614	8,207	62	1,004,809
West Coast of Mexico	21,830	18,853	59,758	15,972	14,344	22,940	102,986	275,354	34,480	99,109	116,180	83,301	865,107
Totals	21,894	19,024	62,840	20,030	141,145	99,629	213,642	616,901	224,338	242,723	124,387	83,363	1,869,916
Miscellaneous—													
West Coast of Mexico	557	785	295	4,107	410							3,342	9,496
Spiny Lobsters—													
Local	46,001	24,761								23,793	18,565	18,705	131,825
West Coast of Mexico	184,088	178,022	132,682							40,785	54,226	130,661	720,464
Totals	230,089	202,783	132,682							64,578	72,791	149,366	852,289
Turtles—													
West Coast of Mexico					5,439					155			5,594
Grand totals	3,265,100	4,887,499	3,717,224	2,963,241	3,813,145	1,367,137	3,259,033	4,690,695	5,860,041	5,345,082	3,563,418	3,332,973	46,064,588

1928 MONTHLY LANDINGS FOR THE STATE OF CALIFORNIA

The combined landings in all districts of the state are shown in the following table. (See also table of "Totuava Importations, 1928," on page 109.) As in the preceding tables these figures include importations and the point of origin of the catches is shown as well as the total landings for each species where the catches are not made entirely off the coast of the State of California.

STATE OF CALIFORNIA

1928

Species of fish	January	February	March	April	May	June	July	August	September	October	November	December	Total
Albacore—													
Local	90		258			35	297,229	74,853	851				283,321
Hawaii						8,616		10,793	7,468	18,146	6,521	5,909	57,453
Japan	495,268	813,207	1,318,359	665,318	265,793	159,636						7,374	3,724,955
Totals	495,358	813,207	1,318,617	665,318	265,793	168,287	207,229	85,651	8,319	18,146	6,521	13,283	4,065,729
Anchovies	1,190	155		23,137	187,335	48,804	12,031	43,543	30,680	9,905	345	345	357,470
Barracuda—													
Local	1,950	1,830	58,797	791,656	1,176,051	658,567	828,557	693,936	98,840	53,984	9,838	11,208	4,385,214
West Coast of Mexico	212,355	155,192	251,911	5,875	1,133	1,332	6,675	95,777	162,226	568,094	317,162	289,510	2,067,242
Totals	214,305	157,022	310,708	797,531	1,177,184	659,899	835,232	789,713	261,066	622,078	327,000	300,718	6,452,456
Bonito—													
Local	13,891	10,990	10,137	11,364	310,873	167,988	348,031	221,113	192,687	41,471	6,610	378	1,335,533
West Coast of Mexico	22,830	9,274	5,904	780		12,057		6,308	48,470	322,929	254,211	87,607	770,370
Totals	36,721	20,264	16,041	12,144	310,873	180,045	348,031	227,421	241,157	364,400	260,821	87,985	2,105,903
Cabrilla—													
West Coast of Mexico												1,575	1,575
Carp	10,676	8,317	17,890	50,364	50,447	1,397	1,656	5,512	1,454	227	3,377	5,966	157,283
Catfish	21,896	34,974	62,607	75,333	22,264			35,426	50,853	62,007	59,468	34,273	459,101
Corvina—													
Gulf of Lower California	3,305		6,802	4,267									14,374
Cultus Cod	37,967	50,474	94,783	94,688	53,142	72,516	49,274	88,558	104,811	97,566	36,699	73,059	853,537
Eels			5		222								227
Flounders	12,881	24,750	63,786	30,981	51,183	23,302	80,662	32,493	20,604	44,610	7,859	6,769	399,880
Grayfish	58,409	30,203	36,742	36,574	26,175	17,215	33,152	19,411	65,102	73,623	67,418	159,792	623,816
Hake				750	18,030	22,232	33,094	7,895	3,150	6,308	14,287	2,902	108,648
Halibut—													
Local	91,678	177,428	184,106	202,615	109,052	77,569	83,866	108,139	107,186	87,027	39,735	39,728	1,308,129
West Coast of Mexico	26,057	29,324	23,541	18,179	17,711	26,734	32,013	43,851	19,771	9,406	1,799	6,976	255,362
Totals	117,735	206,752	207,647	220,794	126,763	104,303	115,879	151,990	126,957	96,433	41,534	46,704	1,563,491
Hardhead	17,255	2,896	2,096	2,120	9,215				50	315	11,256	16,496	61,699
Herring	480,429	377,816	94,220	12,525		100	140	1,000			13,457	159,995	1,139,682
Kingfish	61,528	50,876	44,923	41,090	31,823	34,791	31,067	19,548	13,695	30,205	36,813	45,399	441,758
Mackerel—													
Local	710,003	779,330	813,773	829,194	1,907,142	648,843	2,948,733	4,630,830	5,335,247	8,433,609	4,187,822	4,026,772	35,251,298
West Coast of Mexico										1,805	7,806	1,585	11,196
Totals	710,003	779,330	813,773	829,194	1,907,142	648,843	2,948,733	4,630,830	5,335,247	8,435,414	4,195,628	4,028,357	35,262,494

STATE OF CALIFORNIA—Continued

Species of fish	January	February	March	April	May	June	July	August	September	October	November	December	Total
Mackerel—Horse—													
Local	22,716	39,493	24,133	4,798	11,894	31,940	64,621	67,063	79,712	86,305	50,879	54,892	538,446
West Coast of Mexico			200						162		800	744	1,906
Totals	22,716	39,493	24,333	4,798	11,894	31,940	64,621	67,063	79,874	86,305	51,679	55,636	540,352
Mullet—													
Local	200	160	2,198	240	1,316	4,232	6,155	9,936	2,846	769	141	1,046	29,239
West Coast of Mexico	21,976	7,649	5,734	5,056	2,783							10,302	53,500
Totals	22,176	7,809	7,932	5,296	4,099	4,232	6,155	9,936	2,846	769	141	11,348	82,739
Perch—													
Local	18,131	21,672	24,987	61,866	2,594	4,170	24,485	19,572	16,632	19,527	12,295	9,753	235,684
West Coast of Mexico		940	250									100	1,290
Totals	18,131	22,612	25,237	61,866	2,594	4,170	24,485	19,572	16,632	19,527	12,295	9,853	236,974
Pike	421	779	1,035	228	65	24		29	95		369	735	3,780
Pompano—													
Local	1	22	29	2,226	168	72	65	180	287	101	126	18	3,295
West Coast of Mexico	5,323	5,236	5,225	8,565	1,832							606	26,787
Totals	5,324	5,258	5,254	10,791	2,000	72	65	180	287	101	126	624	30,082
Rock Bass—													
Local	21,668	23,903	20,745	39,504	53,828	101,486	121,546	83,240	43,726	37,289	17,093	11,595	575,623
West Coast of Mexico	1,094	4,520	8,659	257	3,306				520	2,011	8,092	21,867	50,326
Totals	22,762	28,423	29,404	39,761	57,134	101,486	121,546	83,240	44,246	39,300	25,185	33,462	625,949
Rockfish—													
Local	574,256	767,432	574,975	609,600	573,175	513,922	480,667	453,599	508,027	586,030	362,504	410,784	6,414,971
West Coast of Mexico										430	2,056	2,452	4,938
Totals	574,256	767,432	574,975	609,600	573,175	513,922	480,667	453,599	508,027	586,460	364,560	413,236	6,419,909
Sablefish	33,713	81,807	130,380	128,468	14,745	31,142	25,854	40,761	133,022	150,328	91,720	55,015	916,955
Salmon	161	1,588	12,679	139,126	113,886	1,061,511	1,236,277	1,303,173	471,091	58,753	79,959	452	4,478,566
Sandabs	73,442	86,780	88,388	61,848	123,161	112,494	144,847	95,542	65,134	99,253	81,829	76,046	1,108,764
Sardines	40,874,524	95,819,881	42,943,442	4,195,019	3,380,667	385,908	235,896	45,644,447	53,001,740	46,653,053	40,252,860	46,882,828	420,269,665
Sculpin	4,961	5,080	6,241	4,127	8,335	1,831	6,274	15,794	17,286	7,659	12,767	9,356	99,711
Sea Bass—Black—													
Local	14,221	48,079	8,163	8,966	16,975	14,596	9,308	19,535	18,424	28,954	10,556	7,085	204,862
Gulf of Lower California												410	410
West Coast of Mexico	9,120	6,552	10,739	1,337	189	1,200	9,187	39,947	10,763	43,767	18,828	25,214	176,843
Totals	23,341	54,631	18,902	10,303	17,164	15,796	18,495	59,482	29,187	72,721	29,384	32,709	382,115

Sea Bass– White—													
Local	4,755	2,215	15,043	91,950	109,265	63,474	146 794	177,811	111,622	52,614	27,252	22,084	824,879
West Coast of Mexico	19,161	8,706	18,158	1,347	1,875	28,299	57,320	101,772	77,292	77,124	51,629	32,652	475,335
Totals	23,916	10,921	33,201	93,297	111,140	91,773	204.114	279,583	188,914	129,738	78,881	54,736	1,300,214
Shad	25	351	377	22,827	60,190			5,193	55		4,452	1,289	94,739
Shad—Buck		39	39,045	400,420	324,522	127		3,731	54		315	51	768,304
Shad Roe		30	32,794	539,183	653,731	60		18	3		16		1,225,835
Sheepshead—													
Local	71,416	61,975	21,500	14,558	13,001	2,643	2,054	14,662	37,355	38,210	52,126	42,989	372,489
West Coast of Mexico												188	188
Totals	71,416	61,975	21,500	14,558	13,001	2,643	2,054	14,662	37,355	38,210	52,126	43,177	372,677
Skates	29,478	26,227	49,652	32,629	25,993	20,559	33,119	24,082	38,933	58,736	64,999	54,519	458,926
Skipjack					8			3,118,246	936,962	340,186	630	100	4,396,132
Local					482,576	118,793		610.269	4,405,181	2,724,345	926,960	782,954	11,551,972
West Coast of Mexico	25,605	6,509	672,094	796,686									
Totals	25,605	6,509	672,094	796,686	482,584	118,793		3,728,515	5,342,143	3,064,531	927,590	783,054	15,948,104
Smelt—													
Local	70,646	68,177	87,552	68,665	77,545	87,174	81,938	94,595	85,040	78,445	66,951	48,822	915,550
West Coast of Mexico	75								54			1,092	1,221
Totals	70,721	68,177	87,552	68,665	77,545	87,174	81,938	94,595	85,094	78,445	66,951	49,914	916,771
Sole	962,447	1,070,956	810,501	912,791	1,004,468	748,082	844,542	893,947	782,049	740,297	749,246	762,393	10,281,719
Splittail	2,451	3,086	1,753	275					175		1,861	1,139	10,740
Stingaree					3,296								3,296
Striped Bass	16,750	33,231	63,361	111,617	94,288			64,607	18,622		33,879	47,758	484,113
Suckers	248	547	185	49									1,029
Swordfish			300		1,070	29,638	104,583	129,965	55,427	54,185	50,146	687	426,001
Tomcod				125	125		32	8,218	1,973	1,105	345		11,923
Totuava										19,476	42,258	63,078	841,357
Gulf of Lower California	247,861	212,059	183,342	31,169	39,973	2,141				1,027			13,700,870
Tuna– Bluefin	532,566	332		4,467	2,547	2,837,139	7,424,227	2,461,487	437,078				
Tuna– Yellowfin													
Local	1,320		300	320			25	24,929	48,889	6,358	1,365	1,120	84,626
West Coast of Mexico	1,154,168	1,438,580	2,020,696	6,205,862	5,909,667	687,734		345,815	3,885,832	5,267,602	3,287,702	1,964,922	32,168,580
Totals	1,155,488	1,438,580	2,020,996	6,206,182	5,909,667	687,734	25	370,744	3,934,721	5,273,960	3,289,067	1,966,042	32,253,206
Turbot	131		4	93	720	2,168	4,316	900	250	300	352		9,234
Whitebait	330	1,544	7,514	28,403	43,165	21,860	26,298	3,306	1,463	998	283	22	135,186
Whitefish—													
Local	25,344	24,117	9,780	14,059	7,406	10,387	19,029	4,020	11,327	22,293	21,761	25,985	195,508
West Coast of Mexico	16,006	4,346	526	95	164					919	1,157	3,471	26,684
Totals	41,350	28,463	10,306	14,154	7,570	10,387	19,029	4,020	11,327	23,212	22,918	29,456	222,192
Yellowtail—													
Local	728	10,385	17,631	7,538	157,737	85,916	116,301	426,472	284,490	149,277	33,061	7,501	1,297,037
West Coast of Mexico	52.698	72,824	198,452	38,434	14,344	30,113	102,986	287,281	66,764	205,241	216,740	100,660	1,386,477
Totals	53,426	83,209	216,083	45,972	172,081	116,029	219,287	713,753	351,254	354,518	249.801	108,101	2,683,514

STATE OF CALIFORNIA—Continued

Species of fish	January	February	March	April	May	June	July	August	September	October	November	December	Total
Miscellaneous—													
Local	12,548	11,227	11,767	9,771	19,232	29,257	24,169	22,590	13,645	12,443	8,170	6,916	181,735
West Coast of Mexico	4,872	1,015	295	4,107	410							3,959	14,658
Totals	17,420	12,242	12,062	13,878	19,642	29,257	24,169	22,590	13,645	12,443	8,170	10,875	196,393
Crabs	501,936	621,096	244,632	405,903	386,223	339,264	271,488					366,336	437,856	3,574,734
Shrimps	73,007	106,597	188,371	183,321	178,485	262,352	315,994	295,692	231,786	206,116	140,672	98,568	2,280,871
Spiny Lobsters													
Local	86,333	53,757	299							85,764	59,177	70,470	355,800
West Coast of Mexico	184,088	178,022	132,682							40,785	54,226	131,011	720,814
Totals	270,421	231,779	132,981							126,549	113,403	201,481	1,076,614
Abalones			123,481	282,718	118,655	400,144	369,138	180,073	266,325	188,809	30,123	106,777	2,066,243
Clams—Cockle		85	611	2,795	2,054	1,173	4,973	4,234	1,539	979	1,441	2,767	22,651
Clams—Mixed	5,269	6,360	5,276	8,713	7,292	5,888	164	415	2,596	1,683	552	454	44,662
Clams—Pismo	7,394	7,599	7,565	8,601	10,238	14,711	18,290	15,028	11,332	10,646	7,019	7,409	125,832
Clams—Softshell	12,780	14,219	14,412	8,820	8,972	8,825	12,809	14,920	13,956	11,969	12,910	13,950	148,542
Cuttlefish	108	87	509	724	722	1,290	2,109	1,051	1,692	1,120	103	217	9,732
Mussels	215	240	615	300	20	220							1,610
Oysters—Eastern	39,991	59,054	69,481	62,365	55,273	43,263	34,428	31,982	53,345	74,082	98,202	104,832	726,298
Oysters—Native					4,900	5,400	5,350	3,650	2,500	1,900	1,750	1,400	26,850
Squid	6,015	61,868	214	73,067	837,427	279,733	39,876				53,094	698	1,351,992
Terrapins					168								168
Turtles—													
West Coast of Mexico					5,439					155			5,594
Grand totals	48,124,351	103,646,071	52,009,612	18,542,808	19,209,096	10,414,089	17,123,624	63,302,770	72,518,128	68,110,655	52,554,598	57,517,618	583,073,420

TOTUAVA IMPORTATIONS

In the foregoing tables there have been recorded 841,357 pounds of totuava brought into California from the Gulf of California, Mexico, by trucks. This amount covers poundage reported by dealers to the Division of Fish and Game under the "pink ticket" system. Because this fish is caught in the Gulf of California, Mexico, trucked overland and comes into the United States through inland ports of entry, some of the dealers in California have been under the impression that it is not necessary to make the regular report to the state covering the amounts received. The records therefore are incomplete.

Through the courtesy of the United States customs officials at several of the border entry ports, George Roger Chute of the California State Fisheries Laboratory staff was enabled to check Custom House records of truckloads entering from Mexico bound for California coast cities. The result of this check is given in the table below which raises the totuava receipts to 2,111,116 pounds for 1928. There is a possibility that even this figure is less than the actual amount shipped to California during the year, since it was not possible to check the entries at all of the border towns. Because of the fact that considerable corvina is mixed with the loads of "Mexican white sea bass" or totuava coming over the border, it is difficult to get an accurate check of the actual poundage of each variety imported.

In the arrays shown in figures 2 and 57, the greater amount as taken from the table below was used in an endeavor to give a more accurate picture of the importance of the totuava landings and a better comparison with the figures for other species. Further reference to the confusion in the totuava and white sea bass figures is given on page 48 in the article on "White Sea Bass," by S. S. Whitehead.

TOTUAVA IMPORTATIONS—1928

	Calexico	*Yuma*	*Total*
January	126,194	195,609	321,803
February	234,247	272,765	507,012
March	137,463	297,951	435,414
April	151,813	97,576	249,389
May	24,942	46,155	71,097
June	22,495	9,565	32,060
July	251	200	451
August	671	--------	671
September	10,582	--------	10,582
October	33,706	17,050	50,756
November	30,382	117,896	148,278
December	61,066	222,537	283,603
Totals (calendar year)	833,812	1,277,304	2,111,116

CALIFORNIA DIVISION OF FISH AND GAME FISH BULLETINS

* No. 1. Report on Fish Conditions. 1913; 48 pp., 3 figs. Contains:
The Abalone Industry in California. By Charles Lincoln Edwards.
The Towing of Salmon and Steelhead Fry from Sacramento to the Sea in a "Live Car." By N. B. Scofield.
The Problem of the Spiny Lobster. By Bennet M. Allen.
Investigation of the Clams of California. By Harold Heath.
Investigation of the Life History of the Edible Crab (*Cancer magister*). By F. W. Weymouth.
A General Report on a Quinnat Salmon Investigation carried on during the Spring and Summer of 1911. By N. B. Scofield.
Trout and Black Bass Planting and Transplanting in the San Joaquin and Southern Sierra Districts. By A. D. Ferguson.

* No. 2. The Scientific Investigation of Marine Fisheries as Related to the Work of the Fish and Game Commission in Southern California. By Will F. Thompson. 1919; 27 pp., 4 figs.

* No. 3. The Spawning of the Grunion (*Leuresthes tenuis*). By Will F. Thompson, assisted by Julia Bell Thompson. July 15, 1919; 29 pp., 9 figs.

No. 4. The Edible Clams, Mussels and Scallops of California. By Frank W. Weymouth. Jan. 10, 1921; 74 pp., 19 pls., 26 figs.

* No. 5. A Key to the Families of Marine Fishes of the West Coast. By Edwin C. Starks. March 3, 1921; 16 pp., 4 figs.

* No. 6. A History of California Shore Whaling. By Edwin C. Starks. October, 1922; 38 pp., 22 figs.

* No. 7. The Life History and Growth of the Pismo Clam. By Frank W. Weymouth. 1923; 120 pp., 15 figs., 18 graphs.

* No. 8. Racial and Seasonal Variation in the Pacific Herring, California Sardine and California Anchovy. By Carl L. Hubbs. February, 1925; 23 pp., 4 pls.

* No. 9. Preliminary Investigation of the Purse Seine Industry of Southern California. By Tage Skogsberg. 1925; 95 pp., 23 figs.

* No. 10. The Life History of *Leuresthes tenuis*, an Atherine Fish with Tide-controlled Spawning Habits. By Frances N. Clark. October, 1925; 51 pp., 6 graphs, 7 pls.

No. 11. The California Sardine. By the Staff of the California State Fisheries Laboratory. 1926; 221 pp., 74 figs.
I. Thompson, Will F. The California Sardine and the Study of the Available Supply.
II. Sette, Oscar Elton. Sampling the California Sardine: A Study of the Adequacy of Various Systems at Monterey.
III. Higgins, Elmer H. A Study of Fluctuations in the Sardine Fishery at San Pedro.
IV. Thompson, Will F. Errors in the Method of Sampling Used in the Study of the California Sardine.
V. Scofield, W. L. The Sardine at Monterey: Dominant Size Classes and their Progression, 1919–1923.

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No. 19. Sardine Fishing Methods at Monterey, California. By W. L. Scofield. 1929; 61 pp., 27 figs.

No. 20. The commercial Fish Catch of California for the Year 1928. By the staff of the Bureau of Commercial Fisheries. 1930; 109 pp., 62 figs.

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